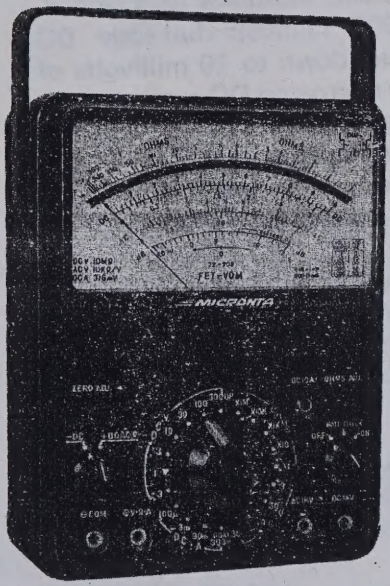
Returned
By
James Linky
No
note!

MICRONTA®

FET – VOM

INSTRUCTION MANUAL



Catalog Number 22-208

CUSTOM MANUFACTURED FOR

RADIO SHACK A DIVISION OF TANDY CORPORATION

Your **MICRONTA FET VOM** has all the advantages of a VTVM, with the portability of a VOM. A dual-Field Effect Transistor provides the high input impedance, with circuit stability that rivals the finest VTVMs.

Power is provided by 2 batteries – a 1½-volt type "C" for the Resistance function and a standard 9-volt rectangular type for the FET Amplifier.

Ranges are set up as convenient multiples of 1 and 3. With the high-sensitivity 300 millivolt full-scale DC voltage range, you can measure down to 10 millivolts of DC voltage (+ or –). The 100 microamp DC current range will let you measure DC currents down as low as just a few microamperes. AC Voltages and DB functions combine to provide great versatility at low AC signal levels (down to about 1/10th of a volt).

The DC polarity switch makes it convenient to check DC voltages without switching leads for opposite polarity. A front panel Battery Check switch assures accurate readings because you know when the 9-volt battery is beginning to weaken.

47" (120 cm) well-insulated test leads with spring-steel bananna-type plugs result in firm, safe, low-resistance circuit connections.

The large 5" (12 cm) color-coded meter scale incorporates a mirrored scale to eliminate parallax reading errors.

Your FET VOM is ideally suited for service, engineering, lab, hobby or class-room use – rugged in construction – portable and accurate. The meter movement is automatically protected from excess circuit current/voltage damage.

Thanks for
the Orden Bill
John Davis
W4QCF

SPECIFICATIONS:

METER : 5", 25μA 3-color, mirrored scale
DC VOLTAGE : 8 Ranges
0.3-1-3-10-30-100-300-1000V
Input impedance; 10 megohm (1000 V range is 32 megohms)
Accuracy ; ±3% full scale
AC VOLTAGE : 5 Ranges
3-30-100-300-1000 V
Input impedance ; 10KΩ/volt
Accuracy ; ±4% full scale

DC CURRENT : 5 Ranges
100μ-3m-30m-300mA-10A
Terminal Voltage ; 316 mV
Accuracy ; ±3% full scale

RESISTANCE : 5 Ranges
Rx1-Rx10-Rx1K-Rx10K-Rx1M (center scale 10)
Rx1 ; 0-1K
Rx10 ; 0-10K
Rx1K ; 0-1M
Rx10K ; 0-10M
Rx1M ; 0-1000M
Accuracy ; ±3% of scale-length

ACCESSORIES
Test Leads ; 47"(120 cm) spring-steel, banana plug style
BATTERIES: Requires one type "C" battery and one 9-volt rectangular type

SIZE: 7" x 5½" x 3-1/8" (18 × 14 × 8 cm) (HWD)
WEIGHT: 1.76 lbs (800g)

DESCRIPTION OF CONTROLS

ZERO ADJ. – use this control to balance the internal circuitry to obtain "0" reading when the FET VOM is ON.

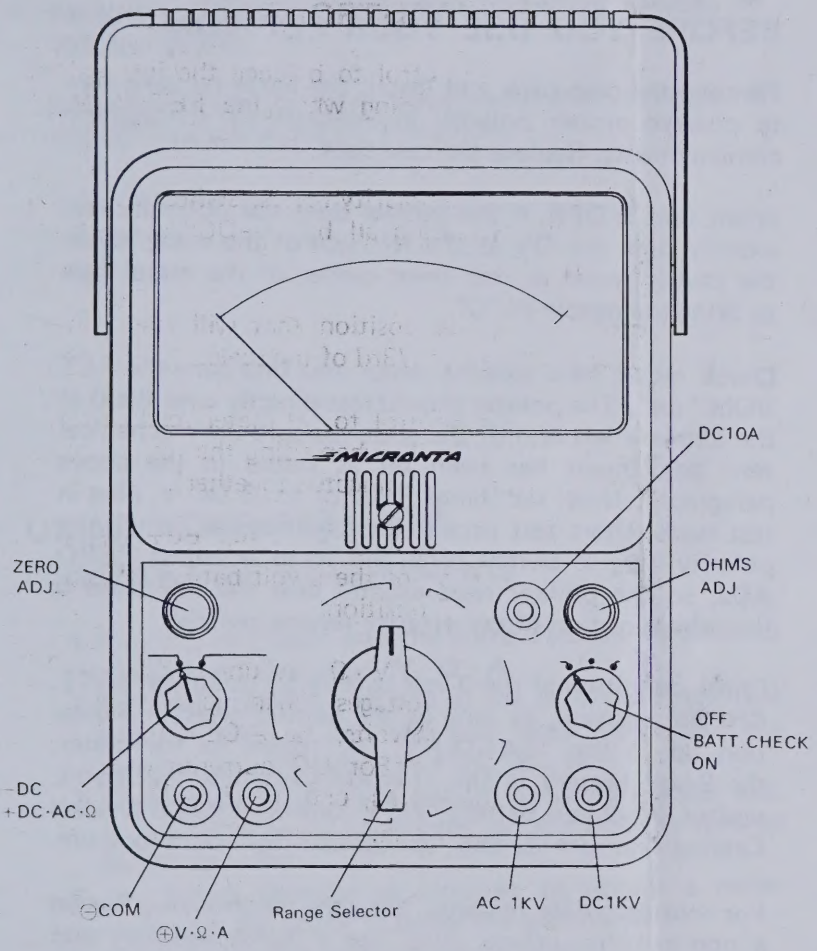
–DC/+DC, AC, Ω – is the polarity reverse switch. Set to +DC, AC, Ω when measuring all but "–DC" currents and voltages.

Range Selector – use the position that will result in a meter reading in the upper 1/3rd of the scale.

OHMS ADJ. – use this control to set meter reading to "0" on the green OHMS scale when using the resistance function (with meter probes connected together).

OFF/BATT. CHECK/ON – use to turn the FET VOM "on" or to check condition of the 9-volt battery. When not in use, leave in the OFF position.

Jacks – use – COM and + V · Ω · A unless you are measuring high DC or AC voltages. When measuring DC or AC voltages of 300-1000 volts, use – COM together with DC 1KV or AC 1KV. For DC currents of 300 miliamperes upto 10 amperes, use the 10A DC jack together with the – COM jack.


MICRONTA
DC10A
ZERO
ADJ.
OHMS
ADJ.
OFF
BATT. CHECK
ON
DC
+DC·AC·Ω
⊖COM
⊕V·Ω·A
Range Selector
AC 1KV
DC1KV

BEFORE YOU USE YOUR FET VOM

Remove the case back and install the batteries; take care to observe proper polarity as indicated on the battery compartments. Replace the case back.

When unit is OFF, if the pointer does not normally rest exactly over the O's at the left side of the scale, adjust the plastic screw in the lower center of the meter face to bring the needle to "0".

Check meter zero balance when you first turn the FET VOM "on". The pointer should rest directly over the 0 at the extreme left end of the scale (be sure the mechanical zero adjustment has been set as noted in the above paragraph). Now, set Range Selector to .3 DC V, plug in test leads, short test probe tips together and switch the polarity reverse switch back and forth – adjust ZERO ADJ. so the pointer rests exactly over the left hand 0 (in either position of the polarity reverse switch).

Check condition of the 9-volt battery by using the BATT. CHECK position; as long as the pointer gives an indication up to the "BATTERY OK" point on the meter, the 9-volt battery is OK. If reading is below that point, replace the 9-volt battery. We recommend Radio Shack's Catalog Number 23-583, or 23-553 for extra-long-life.

For most accurate readings, keep the meter laying flat on a non-metallic surface. Also, use a Range position that results in a meter reading in the upper 1/3rd of the meter scale.

Always observe correct test lead polarity when making DC measurements; the polarity-reverse switch is provided to permit you to make quick polarity changes.

Exercise extreme caution when measuring voltages of 150 and above.

When not in use, or when moving your Instrument, leave ON/OFF switch in the **OFF** position.

USING YOUR FET VOM

DC VOLTAGE MEASUREMENTS

1. Plug the test leads into the correct jacks — Black into – **COM** and Red into + **V · Ω · A.**
2. Set Range Selector to one of the DCV positions; it is best to start at the top and work down. Set the polarity-reversal switch to + **DC, AC, Ω.**
3. Connect the test probe tips to the circuit under test. If the meter reads backwards, set the polarity-reversal switch to — **DC.**
4. Set Range Selector as required to obtain a meter reading in the upper 1/3rd of the meter scale.
5. Read the voltage on the **black** DC scales.
6. For voltages between 300 and 1000 volts, plug the Red test lead into the **DC 1KV** jack. **Use extreme care when using this high-voltage range.**
   NOTE: The **DC 1KV** jack is for use only with DC voltages of 300 to 1000 volts.

AC VOLTAGE MEASUREMENTS

1. Plug the test leads into the correct jacks — Black into ⏚ COM and Red into + V · Ω · A.
2. Set Range Selector to one of the ACV positions; it is best to start at the top and work down. Set the polarity-reversal switch to + DC · AC · Ω.
3. Connect the test probe tips to the circuit under test. Set Range Selector as required to give a meter reading in the upper 1/3rd of the meter scale.
4. Read the voltage on the red AC scale.
5. For voltages between 300 and 1000 volts, plug the Red test lead into the AC 1KV jack. **Use extreme care when using this high-voltage range.**

NOTE: The AC 1KV jack is for use only with AC voltages of 300 to 1000 volts.

DC CURRENT MEASUREMENTS

1. Plug the test leads into the correct jacks — Black into ⏚ COM and Red into + V · Ω · A.
2. Set Range Selector to the 300 m /10A DC A position. Set the polarity-reversal switch to + DC · AC · Ω.
3. Open up the circuit in which you want to measure current and connect the Black test probe to the negative side and the Red to the positive side of the circuit.
4. Apply power to the circuit under test. Set Range Selector to a position which will give a meter reading in the upper 1/3rd of the scale. Read current on the black DC scale.

   If the meter reads backwards, set polarity-reversal switch to — DC.

NOTE: **Do not attempt to read AC current.**

NOTE: If the current will be greater than 300 milli-amps, plug the Red test lead into the DC 10A jack.

RESISTANCE MEASUREMENTS

> Before taking any resistance measurements, disconnect power to the unit under test and discharge capacitors. It is best to remove batteries and unplug line cords.

1. Plug the test leads into the proper jacks – Black to – COM and Red to + V · Ω · A. Set polarity-reversal switch to + DC · AC · Ω.
2. Set Range Selector to one of the OHMS positions; touch the probe tips together and adjust OHMS ADJ. control to bring the pointer to the "0" on the top OHMS scale (green).
3. Now, connect the probe tips across the circuit or part under test. When measuring resistance, it is best to disconnect one side of the part under test (thus the remainder of the circuit will not interfere with the reading).
4. Read the resistance on the green OHMS scale; use the proper multiplier to obtain the correct value (R "times" 1, 10, 1,000, 10,000 or 1,000,000, depending on the position of the Range Selector).

NOTES: When you are unable to adjust the pointer to "0" on the OHMS scale in any OHMS position, the 1.5-volt C cell battery must be replaced.

The polarity-reversal switch must be left in the + DC · AC · Ω position for all resistance measurements.

DECIBEL MEASUREMENTS

1. Plug the test leads into the proper jacks – Black into – COM and Red into + V · Ω · A.

2. Set Range Selector to one of the ACV positions; use a range that provides a meter reading in the upper 1/3rd of the meter scale.
3. Read dB on the dB scale, adding the appropriate number of dB to the dB scale reading as noted in the chart at the lower right of the meter face.

NOTE: For absolute dB measurements, circuit impedance must be 600 ohms. 0 dB=1 milliwatt dissipated in a 600 ohm impedance (equivalent to 0.775 volts across 600 ohms).

For additional ideas and information on how to use your Instrument, we suggest you obtain a copy of Radio Shack's book REALISTIC GUIDE TO VOM'S AND VTVM'S.

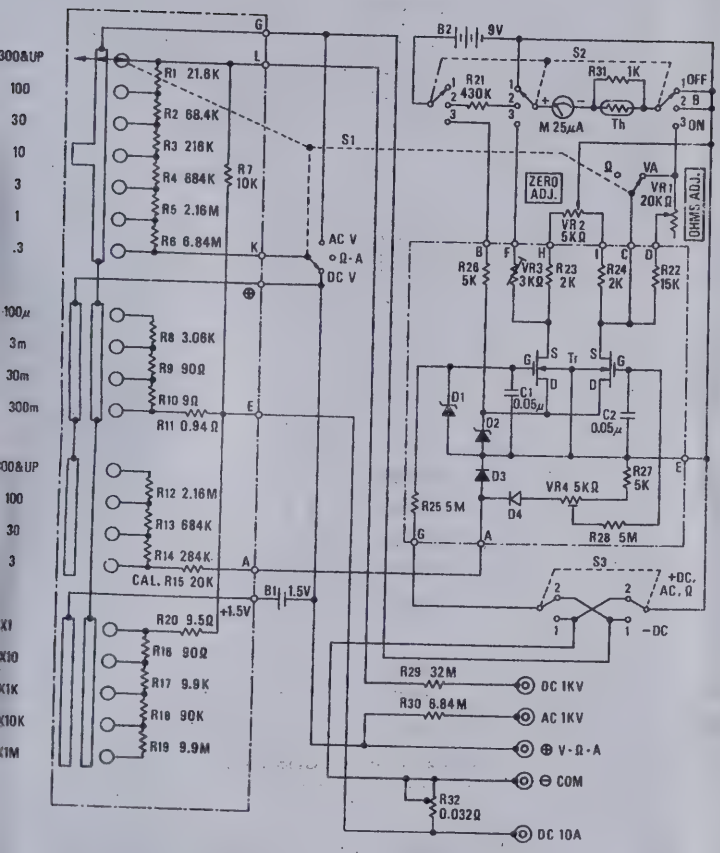
MAINTENANCE

Your FET VOM is ruggedly constructed and the meter movement is automatically protected from voltage or current overloads. Thus, your Instrument should require little or no service or repair – providing you treat it with a normal amount of respect. Don't subject your unit to excessive shock or measuring abuse.

Periodically check the condition of the 9-volt battery. When using the BATT. CHECK switch, the meter pointer should read above the BATT. OK line. If not, replace the 9-volt battery. We recommend Radio Shack's Catalog Number 23-583 or 23-553 for extra-long-life.

If you can no longer "zero" the meter reading on an OHMS range, with the probes shorted together, it's time to replace the 1½-volt C battery. We recommend Catalog Number 23-581, or 23-551 for extra-long-life.

SCHEMATIC DIAGRAM



'E : Resistance values are indicated in ohms unless rwise specified (K=1,000 ohms and M=megohms). citance values are shown in microfarads unless other- noted (P=micro-microfarads).

RADIO SHACK LIMITED WARRANTY

This equipment is warranteed against defects for 90 days from date of purchase. Within this period, we will repair it without charge for parts and labor. Simply **bring your sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover equipment subjected to misuse or accidental damage.

This Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

We Service What We Sell

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MICRONTA®

30,000 OHMS/VOLT MULTITESTER

INSTRUCTION MANUAL

CAT. NO. 22-210

CUSTOM MANUFACTURED FOR RADIO SHACK, A DIVISION OF TANDY CORPORATION

This sensitive Multitester is designed to measure AC and DC voltage, DC currents and resistance -- with accuracy and ease. The 5" (12 cm), sensitive meter incorporates a mirrored-scale for accurate readings and uses 3 colors for rapid scale identification. An "off" position is incorporated for meter protection during transit. This instrument will provide many years of accurate voltage, current and resistance measurements.

We've incorporated a special audible continuity function. When using this function, the built-in buzzer will sound when the circuit continuity is approximately 300 ohms (or less).

The meter circuit incorporates a fuse to protect the delicate meter movement and other internal parts in case of inadvertent overload or improper function selection.

Ranges are set up as convenient multiples of 1 and 3. With the high-sensitivity 1 volt full-scale DC voltage range, you can measure down to 20 millivolts of DC voltage (+ or –). The 100 microamp DC current range will let you measure DC currents down as low as just a few microamperes. AC Voltages and DB functions combine to provide great versatility at low AC signal levels (down to about 1/10th of a volt).

The DC polarity switch makes it convenient to check DC voltages without switching leads for opposite polarity.

44" (110 cm) well-insulated test leads with spring-steel banana-type plugs result in firm, safe, low-resistance circuit connections.

Power is provided by 2 batteries – a 1½-Volt type "C" for the R x 1, R x 10, R x 1K Ranges and a 9-Volt rectangular type for R x 10K and CONT. Ranges.

SPECIFICATIONS

RANGES	27
DC Voltage	0-1-3-10-30-100-300-1000 Volts
AC Voltage	0-3-30-100-300-1000 Volts
DC Current	0-100μ-1-30-300m-10A
Resistance	0-1-10K-1-10meg (Center scale 10) Continuity 0 – 300 ohm Approx.
Decibels	–20 to + 62 in 5 ranges
Output	0-3-30-100-300-600 Volts
ACCURACY	
DC Voltage	±3% of full scale
AC Voltage	±4% of full scale
Frequency response	
45 Hz to 1 KHz	± 1% up to 30V
to 10 KHz	± 3% up to 30V
Resistance	±3% of scale length on Resistance
SENSITIVITY	DC: 30,000 ohms/volt AC: 10,000 ohms/volt
METER MOVEMENT	5" (12 cm), 3-color, mirrored scale, 25μamp full scale
BATTERIES	Requires one type "C" battery and one 9-volt rectangular type
LEADS	44" (110 cm) spring-steel, banana-plug style
FUSE	0.5A, 250V
SIZE	7" x 5-1/2" x 3-1/8" (HWD) (18 x 14 x 8 cm)
WEIGHT	850 g

EXPLANATION OF CONTROLS AND MARKINGS

1. **Range Switch** – use the position that will result in a meter reading in the upper 1/3rd of the scale.

2. **–DC/+DC·AC·Ω** – is the polarity reverse switch. Set to **+DC·AC·Ω** when measuring all but "**–DC**" currents and voltages.

3. **OHMS ADJ** – use this control to set meter reading to "0" on the green OHMS scale when using the resistance function (with meter probes connected together).

4. **Jacks** – use ⊖ **COM** and ⊕ **V-Ω-A** unless you are measuring high DC or AC voltages. When measuring DC or AC voltages of 300-1000 volts, use ⊖ **COM** together with ⊕ DC 1KV or AC 1KV. For DC currents of 300 milliamperes up to 10 ampers, use the ⊕ DC 10A jack together with the ⊖ **COM** jack.

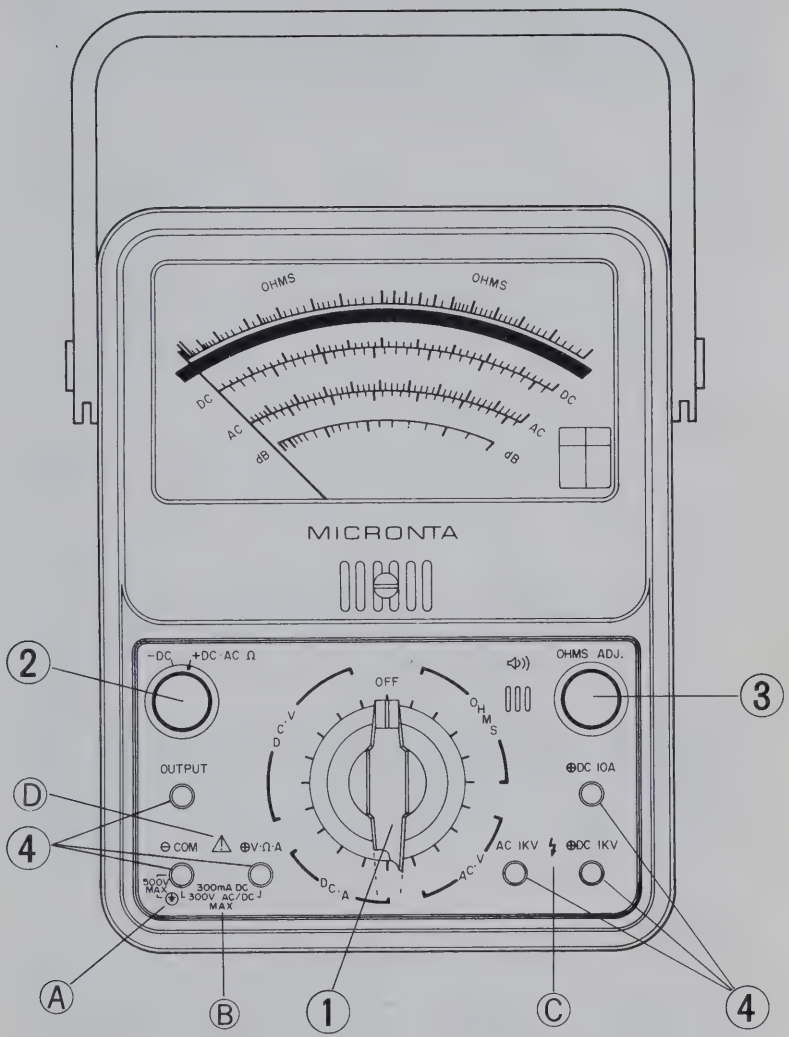
Special marking has been added to the panel to remind you of safety.

A. 500V MAX ⏚ To avoid electrical shock and/or instrument damage, do not connect the common input terminal (–jack) to any source of more than 500 volts with respect to earth/ground.

B. 300mA DC 300V AC/DC MAX The maximum voltage or current that can be measured is 300V AC/DC, or 300mA DC.

C. ϟ Be extra careful when making measurements for high voltage; do not touch terminals or probe ends.

D. ⚠ Refer to complete operating instructions.


OHMS
OHMS
DC
AC
dB
DC
AC
dB
MICRONTA
-DC
+DC AC Ω
OFF
OHMS ADJ.
OUTPUT
⊕DC 10A
⊖ COM
⊕V·Ω·A
500V MAX
300mA DC 300V AC/DC MAX
AC 1KV
⊕DC 1KV
DC·V
OHMS
DC·A
AC·V
2
3
D
4
A
B
1
C
4

USING YOUR MULTITESTER

You'll need one 9-volt battery for R x 10K and CONT. Ranges, and one "C" cell for the other resistance ranges. We recommend our 23-583/553 for 9V, 23-581/551 for "C".
Remove the Battery/Fuse Compartment Cover on the rear by loosening the screw and install batteries in the correct Compartment. Be sure to observe proper polarity. Replace Compartment Cover.

For most accurate readings, keep the meter laying flat on a non-metallic surface.
Also, use a Range setting that results in a reading in the upper 1/3rd of the meter scale.

Also, look at the scale from the point where the pointer and its reflection on the mirror come together: otherwise a reading error due to parallax will result.

If the pointer does not normally rest exactly over "0" at the left side of the scale, adjust the plastic screw in the lower center of the meter face to bring the needle to "0".

Always observe correct test lead polarity when making DC measurements: Black into ⊖ **COM** and Red into the ⊕ **V-Ω-A** (or ⊕ **DC 1KV** or **AC 1KV** or ⊕ **DC 10A**) jacks.
The maximum input limit for voltage and current measurement between ⊕ **V-Ω-A** and ⊖ **COM** is 300V AC/DC and 300mA DC.

TEST LEADS

Use only the same type of test leads as are supplied with your unit. These test leads are rated for 1000 volts; replacements are available from your local Radio Shack store.

DC VOLTAGE MEASUREMENTS

WARNING ϟ : USE EXTREME CARE WHEN MAKING MEASUREMENTS FOR HIGH VOLTAGE; DO NOT TOUCH TERMINAL OR PROBE ENDS.

1. Plug the test leads into the correct jacks – Black into ⊖ **COM** and Red into ⊕ **V-Ω-A**.
2. Set Range Selector to one of the **DCV** positions; it is best to start at the top and work down. Set the polarity-reversal switch to **+DC·AC·Ω**.
3. Connect the test probe tips to the circuit under test. If the meter reads backwards, set the polarity-reversal switch to **–DC**.
4. Set Range Selector as required to obtain a meter reading in the upper 1/3rd of the meter scale.
5. Read the voltage on the black DC scales.
6. For voltages between 300 and 1000 volts, plug the Red test lead into the ⊕ **DC 1 KV** jack. **Use extreme care when using this high-voltage range.**
   NOTE: The ⊕ **DC 1 KV** jack is for use only with DC voltages of 300 to 1000 volts.

AC VOLTAGE MEASUREMENTS

WARNING ϟ : USE EXTREME CARE WHEN MAKING MEASUREMENTS FOR HIGH VOLTAGE; DO NOT TOUCH TERMINAL OR PROBE ENDS.

1. Plug the test leads into the correct jacks – Black into ⊖ **COM** and Red into ⊕ **V-Ω-A**.
2. Set Range Selector to one of the **ACV** positions; it is best to start at the top and work down. Set the polarity-reversal switch to **+DC·AC·Ω**.
3. Connect the test probe tips to the circuit under test. Set Range Selector as required to give a meter reading in the upper 1/3rd of the meter scale.
4. Read the voltage on the red **AC** scale.

5. For voltages between 300 and 1000 volts, plug the Red test lead into the **AC 1KV** jack. **Use extreme care when using this high-voltage range.**

NOTE: The **AC 1KV** jack is for use only with AC voltages of 300 to 1000 volts.

DC CURRENT MEASUREMENTS

WARNING: DO NOT APPLY VOLTAGE TO MEASURING TERMINAL WHILE RANGE SWITCH IS IN CURRENT POSITION.

1. Plug the test leads into the correct jacks — Black into ⊖ **COM** and Red into ⊕ **V-Ω-A.**
2. Set Range Selector to the 300m (10A) **DC A** position. Set the polarity-reversal switch to **+DC·AC·Ω.**
3. Open up the circuit in which you want to measure current and connect the Black test probe to the negative side and the Red to the positive side of the circuit.
4. Apply power to the circuit under test. Set Range Selector to a position which will give a meter reading in the upper 1/3rd of the scale. Read current on the black DC scale.

   If the meter reads backwards, set polarity-reversal switch to — **DC.**

NOTE: Do not attempt to read AC current.

NOTE: If the current will be greater than 300 milliamps, plug the Red test lead into the ⊕ **DC** 10A jack.

RESISTANCE MEASUREMENTS

WARNING: DO NOT APPLY VOLTAGE TO MEASURING TERMINALS WHILE RANGE SWITCH IS IN OHMS POSITION.

Before taking any resistance measurements, disconnect power to the unit under test and discharge capacitors. It is best to remove batteries and unplug line cords.

1. Plug the test leads into the proper jacks — Black to ⊖ **COM** and Red to ⊕ **V-Ω-A.** Set polarity-reversal switch to **+DC·AC·Ω.**
2. Set Range Selector to one of the **OHMS** positions; touch the probe tips together and adjust **OHMS ADJ.** control to bring the pointer to the "0" on the top OHMS scale (green).
3. Now, connect the probe tips across the circuit or part under test. When measuring resistance, it is best to disconnect one side of the part under test (thus the remainder of the circuit will not interfere with the reading).
4. Read the resistance on the green OHMS scale; use the proper multiplier to obtain the correct value (R "times" 1, 10, 1,000, 10,000 depending on the position of the Range Selector).
5. CONT. position is for continuity checking. When resistance is 0 to 300 ohms, the built-in buzzer sounds. The level of sound reduces as the resistance increases.

NOTES: When you are unable to adjust the pointer to "0" on the OHMS scale in the R x 1, R x 10 or R x 1K position, the 1.5-volt C cell battery must be replaced.

When you are unable to adjust the pointer to "0" on the OHMS scale in the R x 10K position, or the continuity buzzer does not sound in the CONT. position when leads are shorted, the 9-volt battery must be replaced.

The polarity-reversal switch must be left in the **+DC·AC·Ω** position for all resistance measurements.

DECIBEL MEASUREMENTS

1. Plug the test leads into the proper jacks — Black into ⊖ **COM** and Red into ⊕ **V-Ω-A.**
2. Set Range Switch to one of the **ACV** positions; use a range that provides a meter reading in the upper 1/2 of the meter scale.
3. Read dB on the dB scale, adding the appropriate number of dB to the dB scale reading as noted in the chart at the lower right of the meter face.

NOTE: For absolute dB measurements, circuit impedance must be 600 ohms. 0 dB = 1 milliwatt dissipated in a 600 ohm impedance (equivalent to 0.775 volts across 600 ohms).

OUTPUT VOLTAGE MEASUREMENT

1. To measure AC voltage in the presence of DC voltage, use the OUTPUT function. Connect the Black lead to the ⊖ **COM** jack and the Red lead to the **OUTPUT** jack.
2. Set Function switch to **+DC·AC·Ω** position.
3. Set the Range switch to an **AC V** position and measure the voltage in the circuit.

NOTE: The function incorporates a DC blocking capacitor, rated at 600 volts.
Thus, do not exceed the 600 volts rating when measuring output voltage.

4. Read output voltages on the same scale as for AC voltage.

REPLACEMENT OF BATTERY/FUSE

WARNING: TO AVOID ELECTRIC SHOCK, DISCONNECT MEASURING TERMINALS BEFORE REMOVING BATTERY OR FUSE. REPLACE ONLY WITH SAME TYPE BATTERY OR FUSE. THIS INSTRUMENT CONTAINS NO USER SERVICEABLE PARTS.
SCREW REMOVAL BY QUALIFIED PERSONS ONLY.
CAUTION: FOR CONTINUED PROTECTION AGAINST FIRE, REPLACE ONLY WITH 0.5A, 250V FUSE.

To install or replace the Batteries/Fuse, loosen the screw on Battery/Fuse Compartment Cover to open.

NOTE: The fuse will blow when voltage is applied in resistance or current mode. In this case there will be no meter movement (Replace the fuse).

1. Disconnect the test leads.
2. Open the Battery/Fuse Compartment Cover.
3. Pull the red ribbon in the Fuse Compartment. The fuse will pop out.
4. Insert a new fuse on the ribbon ring. Use only a fuse of the same type/rating (0.5A, 250V).
5. Install fuse with ribbon in the Fuse Compartment.
6. Close the Battery/Fuse Compartment Cover.

WARNING: DO NOT OPERATE THE UNIT UNTIL THE BATTERY COVER IS IN PLACE AND FULLY CLOSED.

GOOD METER MEASUREMENT PRACTICES

There are some good general rules which apply to the use of electrical meters. Some are common-sense, some are safety precautions and some are just plain good habits to get into.

1. **CAUTION.** There is always the possibility of dangerous voltages being present in any piece of electrical/-electronic equipment. Always use extreme caution when making measurements — high voltage may appear at unexpected points in a suspected defective circuit.

2. When making measurements, never stand on a wet or damp floor. Do not work near (or on) any grounded metal object — for example, a metal work table, metal water or gas pipes, metal electrical conduit. Accidental contact between the grounded metal object and the circuit under test can be lethal.

3. Always use only well insulated test leads. Never use test leads without insulated test prods. Never allow your fingers to touch the bare metal part of the test probes (or circuit points).

4. Never use test leads with frayed or broken insulation; voltages will appear at all exposed contact points on the leads.

5. Never attempt to measure voltages or currents above the specified maximum the meter is designed for; refer to Specifications section (Page 3).

6. For safety's sake, disconnect leads as soon as you've completed measurements.

7. Always turn off the unit's power before connecting test leads. This is especially true when working on circuits with 100 or more volts.

8. Get into the habit of keeping one hand in your pocket when trouble-shooting any equipment containing high voltage circuitry.

9. You should remember that even a small shock can be dangerous, for your body's reaction to a minor shock can cause you to bump or fall against a higher voltage contact.

10. Discharge filter capacitors before connecting test leads; such capacitors can retain hazardous charges in units with high voltage circuits.

11. When making voltage and current measurements always start with the highest range available.

12. Never attempt to measure a voltage when the function is set to resistance or current (it may burn out the meter movement or other circuitry). Never attempt to measure current with the meter set for resistance.

13. Never attempt to measure AC voltages or current with the meter set to a DC mode (meter circuitry can be damaged).

14. Do not attempt to measure RF voltages with the Meter (it can be damaged, or at best the readings will be meaningless).

15. Do not expose your meter to moisture; avoid high humidity and excessive dust and dirt.

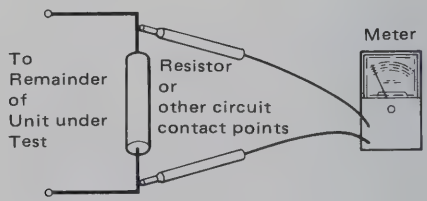
16. Avoid vibration or mechnical shock; the meter might be damaged or its accuracy affected.

17. Avoid using meters in locations with high magnetic fields (inaccurate measurements can result).

18. Remember that voltage and resistance measurements are made with the Meter connected in parallel. Current measurements are made with the meter connected in series.

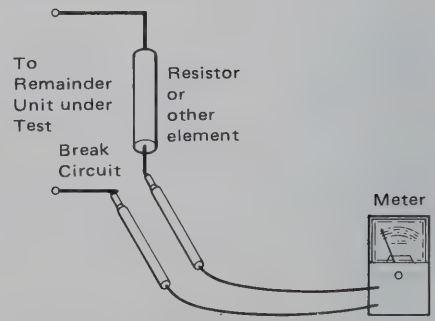
PARALLEL METER CONNECTION

For Voltage and Resistance measurements

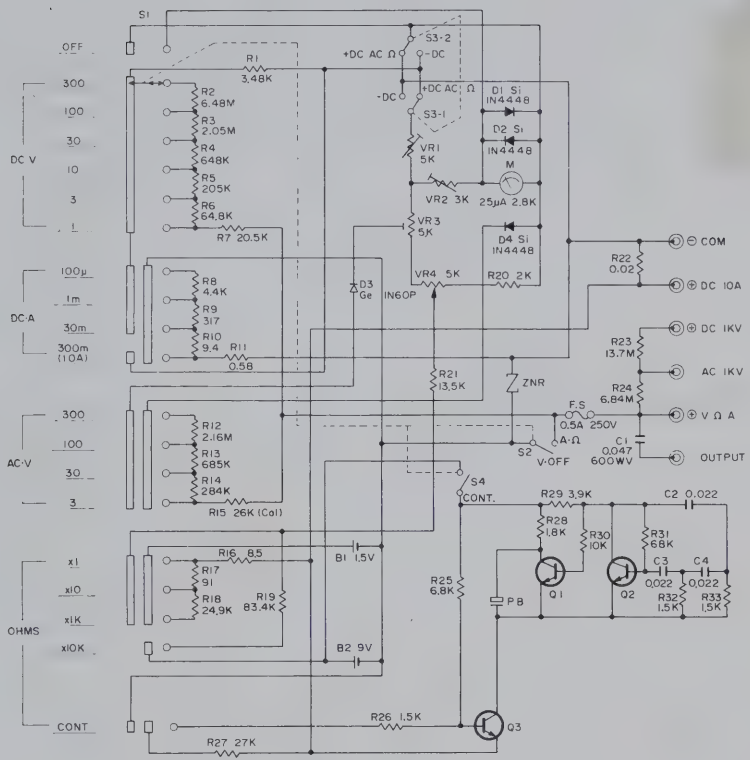


SERIES METER CONNECTION

For Current measurements



SCHEMATIC DIAGRAM



Q1,2,3:
2SC1815 (Y,GR) or
2SC536 (F,G,H) or
KTN5014 (Y,GR,BL) or
MPS9532 (I,J,K,L)

NOTE
(1) ALL RESISTANCE VALUES ARE INDICATED IN "OHM" (K=10^3 OHM M=10^6 OHM)
(2) ALL CAPACITANCE VALUES ARE INDICATED IN "μF"

RADIO SHACK LIMITED WARRANTY

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This Warranty gives you specific legal rignts and you may also have other rights which vary from state to state.

We Service What We Sell

RADIO SHACK, A DIVISION OF TANDY CORPORATION

U.S.A.: FORT WORTH, TEXAS 76102
CANADA: BARRIE, ONTARIO L4M 4W5

TANDY CORPORATION

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Printed in Korea

MICRONTA®

30,000 OHMS/VOLT MULTITESTER

INSTRUCTION MANUAL

CAT. NO. 22-210

CUSTOM MANUFACTURED FOR RADIO SHACK, A DIVISION OF TANDY CORPORATION

This sensitive Multitester is designed to measure AC and DC voltage, DC currents and resistance -- with accuracy and ease. The 5" (12 cm), sensitive meter incorporates a mirrored-scale for accurate readings and uses 3 colors for rapid scale identification. An "off" position is incorporated for meter protection during transit. This instrument will provide many years of accurate voltage, current and resistance measurements.

We've incorporated a special audible continuity function. When using this function, the built-in buzzer will sound when the circuit continuity is approximately 300 ohms (or less).

The meter circuit incorporates a fuse to protect the delicate meter movement and other internal parts in case of inadvertent overload or improper function selection.

Ranges are set up as convenient multiples of 1 and 3. With the high-sensitivity 1 volt full-scale DC voltage range, you can measure down to 20 millivolts of DC voltage (+ or −). The 100 microamp DC current range will let you measure DC currents down as low as just a few microamperes. AC Voltages and DB functions combine to provide great versatility at low AC signal levels (down to about 1/10th of a volt).

The DC polarity switch makes it convenient to check DC voltages without switching leads for opposite polarity.

44" (110 cm) well-insulated test leads with spring-steel banana-type plugs result in firm, safe, low-resistance circuit connections.

Power is provided by 2 batteries – a 1½-Volt type "C" for the R x 1, R x 10, R x 1K Ranges and a 9-Volt rectangular type for R x 10K and CONT. Ranges.

SPECIFICATIONS

RANGES	27
DC Voltage	0-1-3-10-30-100-300-1000 Volts
AC Voltage	0-3-30-100-300-1000 Volts
DC Current	0-100μ-1-30-300m-10A
Resistance	0-1-10K-1-10meg (Center scale 10) Continuity 0 – 300 ohm Approx.
Decibels	–20 to + 62 in 5 ranges
Output	0-3-30-100-300-600 Volts
ACCURACY	
DC Voltage	±3% of full scale
AC Voltage	±4% of full scale
Frequency response	
45 Hz to 1 KHz	± 1% up to 30V
to 10 KHz	± 3% up to 30V
Resistance	±3% of scale length on Resistance
SENSITIVITY	DC: 30,000 ohms/volt AC: 10,000 ohms/volt
METER MOVEMENT	5" (12 cm), 3-color, mirrored scale, 25μamp full scale
BATTERIES	Requires one type "C" battery and one 9-volt rectangular type
LEADS	44" (110 cm) spring-steel, banana-plug style
FUSE	0.5A, 250V
SIZE	7" x 5-1/2" x 3-1/8" (HWD) (18 x 14 x 8 cm)
WEIGHT	850 g

EXPLANATION OF CONTROLS AND MARKINGS

1. **Range Switch** – use the position that will result in a meter reading in the upper 1/3rd of the scale.

2. **–DC/+DC·AC·Ω** – is the polarity reverse switch. Set to **+DC·AC·Ω** when measuring all but "**–DC**" currents and voltages.

3. **OHMS ADJ** – use this control to set meter reading to "0" on the green OHMS scale when using the resistance function (with meter probes connected together).

4. **Jacks** – use ⊖ **COM** and ⊕ **V-Ω-A** unless you are measuring high DC or AC voltages. When measuring DC or AC voltages of 300-1000 volts, use ⊖ **COM** together with ⊕ DC 1KV or AC 1KV. For DC currents of 300 milliamperes up to 10 ampers, use the ⊕ DC 10A jack together with the ⊖ **COM** jack.

Special marking has been added to the panel to remind you of safety.

A. 500V MAX ⏚ To avoid electrical shock and/or instrument damage, do not connect the common input terminal (–jack) to any source of more than 500 volts with respect to earth/ground.

B 300mA DC 300V AC/DC MAX The maximum voltage or current that can be measured is 300V AC/DC, or 300mA DC.

C. ϟ Be extra careful when making measurements for high voltage; do not touch terminals or probe ends.

D. ⚠ Refer to complete operating instructions.

DC VOLTAGE MEASUREMENTS

1. Plug the test leads into the correct jacks – Black into ⊖ **COM** and Red into ⊕ **V-Ω-A.**
2. Set Range Selector to one of the **DCV** positions; it is best to start at the top and work down. Set the polarity-reversal switch to **+DC·AC·Ω.**
3. Connect the test probe tips to the circuit under test. If the meter reads backwards, set the polarity-reversal switch to **–DC.**
4. Set Range Selector as required to obtain a meter reading in the upper 1/3rd of the meter scale.
5. Read the voltage on the black DC scales.
6. For voltages between 300 and 1000 volts, plug the Red test lead into the ⊕ **DC 1 KV** jack. **Use extreme care when using this high-voltage range.**

   NOTE: The ⊕ **DC 1 KV** jack is for use only with DC voltages of 300 to 1000 volts.

AC VOLTAGE MEASUREMENTS

1. Plug the test leads into the correct jacks – Black into ⊖ **COM** and Red into ⊕ **V-Ω-A.**
2. Set Range Selector to one of the **ACV** positions; it is best to start at the top and work down. Set the polarity-reversal switch to **+DC·AC·Ω.**
3. Connect the test probe tips to the circuit under test. Set Range Selector as required to give a meter reading in the upper 1/3rd of the meter scale.
4. Read the voltage on the red **AC** scale.

Before taking any resistance measurements, disconnect power to the unit under test and discharge capacitors. It is best to remove batteries and unplug line cords.

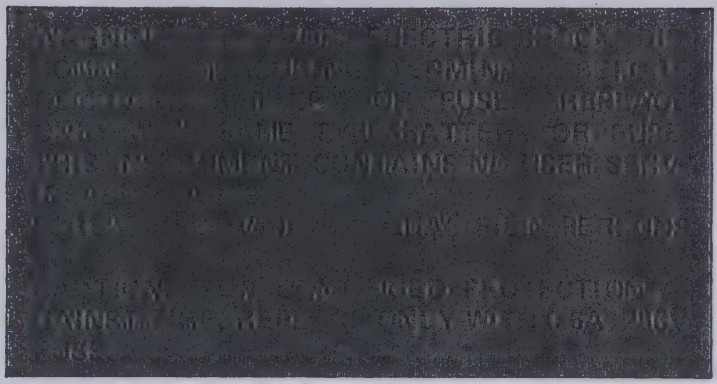
1. Plug the test leads into the proper jacks — Black to ⊖**COM** and Red to ⊕**V-Ω-A**. Set polarity-reversal switch to **+DC·AC·Ω**.
2. Set Range Selector to one of the **OHMS** positions; touch the probe tips together and adjust **OHMS ADJ.** control to bring the pointer to the "0" on the top OHMS scale (green).
3. Now, connect the probe tips across the circuit or part under test. When measuring resistance, it is best to disconnect one side of the part under test (thus the remainder of the circuit will not interfere with the reading).
4. Read the resistance on the green OHMS scale; use the proper multiplier to obtain the correct value (R "times" 1, 10, 1,000, 10,000 depending on the position of the Range Selector).
5. CONT. position is for continuity checking. When resistance is 0 to 300 ohms, the built-in buzzer sounds. The level of sound reduces as the resistance increases.

NOTES: When you are unable to adjust the pointer to "0" on the OHMS scale in the R x 1, R x 10 or R x 1K position, the 1.5-volt C cell battery must be replaced.

When you are unable to adjust the pointer to "0" on the OHMS scale in the R x 10K position, or the continuity buzzer does not sound in the CONT. position when leads are shorted, the 9-volt battery must be replaced.

The polarity-reversal switch must be left in the **+DC·AC·Ω** position for all resistance measurements.

REPLACEMENT OF BATTERY/FUSE



To install or replace the Batteries/Fuse, loosen the screw on Battery/Fuse Compartment Cover to open.

NOTE: The fuse will blow when voltage is applied in resistance or current mode. In this case there will be no meter movement (Replace the fuse).

1. Disconnect the test leads.
2. Open the Battery/Fuse Compartment Cover.
3. Pull the red ribbon in the Fuse Compartment. The fuse will pop out.
4. Insert a new fuse on the ribbon ring. Use only a fuse of the same type/rating (0.5A, 250V).
5. Install fuse with ribbon in the Fuse Compartment.
6. Close the Battery/Fuse Compartment Cover.

8. Get into the habit of keeping one hand in your pocket when trouble-shooting any equipment containing high voltage circuitry.

9. You should remember that even a small shock can be dangerous, for your body's reaction to a minor shock can cause you to bump or fall against a higher voltage contact.

10. Discharge filter capacitors before connecting test leads; such capacitors can retain hazardous charges in units with high voltage circuits.

11. When making voltage and current measurements always start with the highest range available.

12. Never attempt to measure a voltage when the function is set to resistance or current (it may burn out the meter movement or other circuitry). Never attempt to measure current with the meter set for resistance.

13. Never attempt to measure AC voltages or current with the meter set to a DC mode (meter circuitry can be damaged).

14. Do not attempt to measure RF voltages with the Meter (it can be damaged, or at best the readings will be meaningless).

15. Do not expose your meter to moisture; avoid high humidity and excessive dust and dirt.

16. Avoid vibration or mechnical shock; the meter might be damaged or its accuracy affected.

GOOD METER MEASUREMENT PRACTICE

There are some good general rules which apply to the use of electrical meters. Some are common-sense, some are safety precautions and some are just plain good habits to get into.

1. **CAUTION.** There is always the possibility of dangerous voltages being present in any piece of electrical/electronic equipment. Always use extreme caution when making measurements — high voltage may appear at unexpected points in a suspected defective circuit.

2. When making measurements, never stand on a wet or damp floor. Do not work near (or on) any grounded metal object — for example, a metal work table metal water or gas pipes, metal electrical conduit Accidental contact between the grounded metal objec and the circuit under test can be lethal.

3. Always use only well insulated test leads. Never use test leads without insulated test prods. Never allow your fingers to touch the bare metal part of the test probes (or circuit points).

4. Never use test leads with frayed or broken insulation voltages will appear at all exposed contact points o the leads.

5. Never attempt to measure voltages or currents above the specified maximum the meter is designed for refer to Specifications section (Page 3).

6. For safety's sake, disconnect leads as soon as you've completed measurements.

7. Always turn off the unit's power before connecting test leads. This is especially true when working on circuits with 100 or more volts.

DECIBEL MEASUREMENTS

1. Plug the test leads into the proper jacks — Black into ⊖ **COM** and Red into ⊕ **V-Ω-A.**
2. Set Range Switch to one of the **ACV** positions use a range that provides a meter reading in the upper 1/2 of the meter scale.
3. Read dB on the dB scale, adding the appropriate number of dB to the dB scale reading as noted in the chart at the lower right of the meter face.

NOTE: For absolute dB measurements, circuit impedance must be 600 ohms. 0 dB = 1 milliwatt dissipated in a 600 ohm impedance (equivalent to 0.775 volts across 600 ohms).

OUTPUT VOLTAGE MEASUREMENT

1. To measure AC voltage in the presence of DC voltage use the OUTPUT function. Connect the Black lead to the ⊖ **COM** jack and the Red lead to the **OUTPUT** jack.
2. Set Function switch to **+DC·AC·Ω** position.
3. Set the Range switch to an **AC V** position and measure the voltage in the circuit.

NOTE: The function incorporates a DC blocking capacitor rated at 600 volts.
Thus, do not exceed the 600 volts rating when measuring output voltage.

4. Read output voltages on the same scale as for AC voltage.

5. For voltages between 300 and 1000 volts, plug th Red test lead into the **AC 1KV** jack. **Use extrem care when using this high-voltage range.**

NOTE: The **AC 1KV** jack is for use only with A voltages of 300 to 1000 volts.

DC CURRENT MEASUREMENTS

1. Plug the test leads into the correct jacks – Black int ⊖ **COM** and Red into ⊕ **V-Ω-A.**
2. Set Range Selector to the 300m (10A) **DC A** positio Set the polarity-reversal switch to **+DC·AC·Ω.**
3. Open up the circuit in which you want to measu current and connect the Black test probe to th negative side and the Red to the positive side of th circuit.
4. Apply power to the circuit under test. Set Rang Selector to a position which will give a meter readin in the upper 1/3rd of the scale. Read current on th black DC scale.

   If the meter reads backwards, set polarity-revers switch to – **DC.**

NOTE: Do not attempt to read AC current.

NOTE: If the current will be greater than 300 mill amps, plug the Red test lead into the ⊕ **DC 10A** jack.

RESISTANCE MEASUREMENTS

USING YOUR MULTITESTER

You'll need one 9-volt battery for R x 10K and CONT Ranges, and one "C" cell for the other resistance ranges We recommend our 23-583/553 for 9V, 23-581/551 fo "C".
Remove the Battery/Fuse Compartment Cover on th rear by loosening the screw and install batteries in th correct Compartment. Be sure to observe proper polarity Replace Compartment Cover.

For most accurate readings, keep the meter laying flat or a non-metallic surface.
Also, use a Range setting that results in a reading in th upper 1/3rd of the meter scale.

Also, look at the scale from the point where the pointe and its reflection on the mirror come together: otherwis a reading error due to parallax will result.

If the pointer does not normally rest exactly over "0" a the left side of the scale, adjust the plastic screw in th lower center of the meter face to bring the needle to "0"

Always observe correct test lead polarity when makin DC measurements: Black into ⊖ **COM** and Red into th ⊕ **V-Ω-A** (or ⊕ **DC 1KV** or **AC 1KV** or ⊕ **DC 10A** jacks.
The maximum input limit for voltage and current meas urement between ⊕ **V-Ω-A** and ⊖ **COM** is 300V AC/D and 300mA DC.

TEST LEADS

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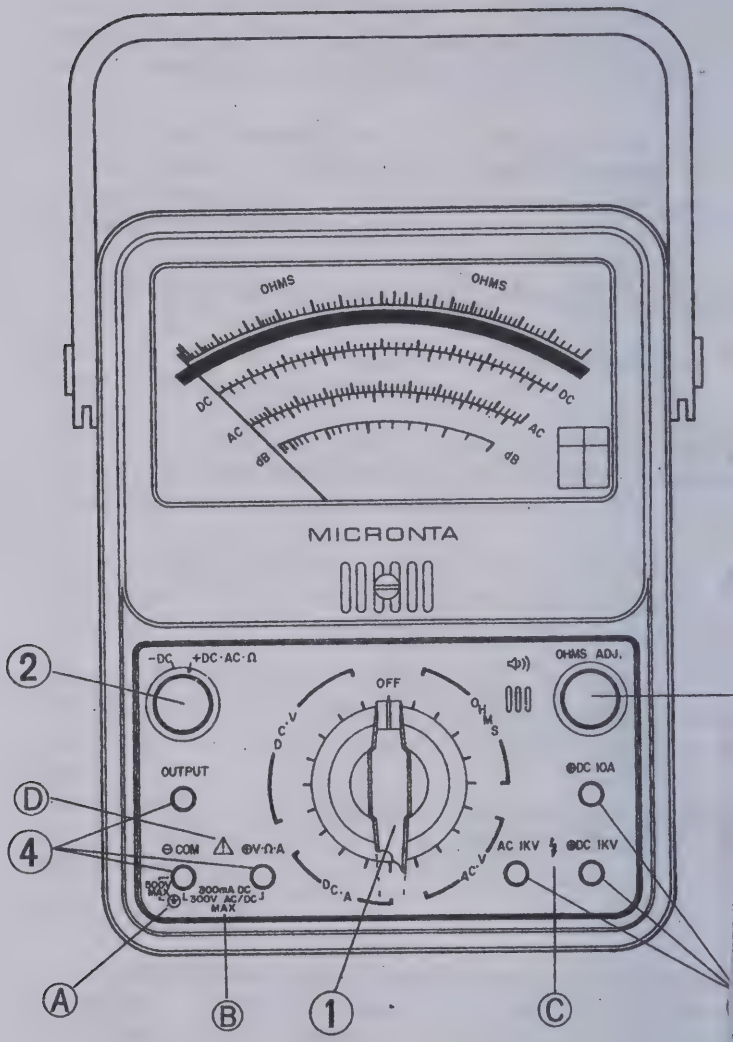
OHMS
OHMS
DC
AC
dB
DC
AC
dB
MICRONTA
-DC +DC·AC·Ω
OFF
OHMS ADJ.
OUTPUT
⊕DC 10A
⊖ COM
⊕V·Ω·A
AC 1KV
⊕DC 1KV
300mA DC
500V AC/DC
MAX
MAX
2
D
4
A
B
1
C

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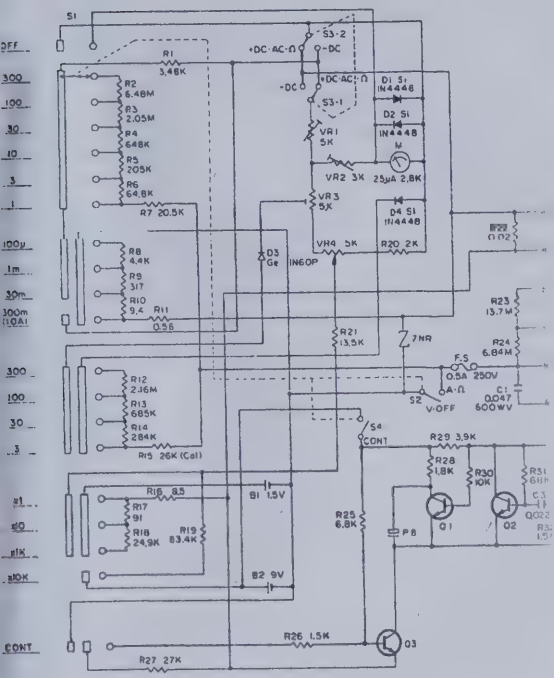

Q1, 2, 3 :
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Output	0-3-30-100-300-600 Volts
ACCURACY	
DC Voltage	±3% of full scale
AC Voltage	±4% of full scale
Frequency response	
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Resistance	±3% of scale length on Resistance
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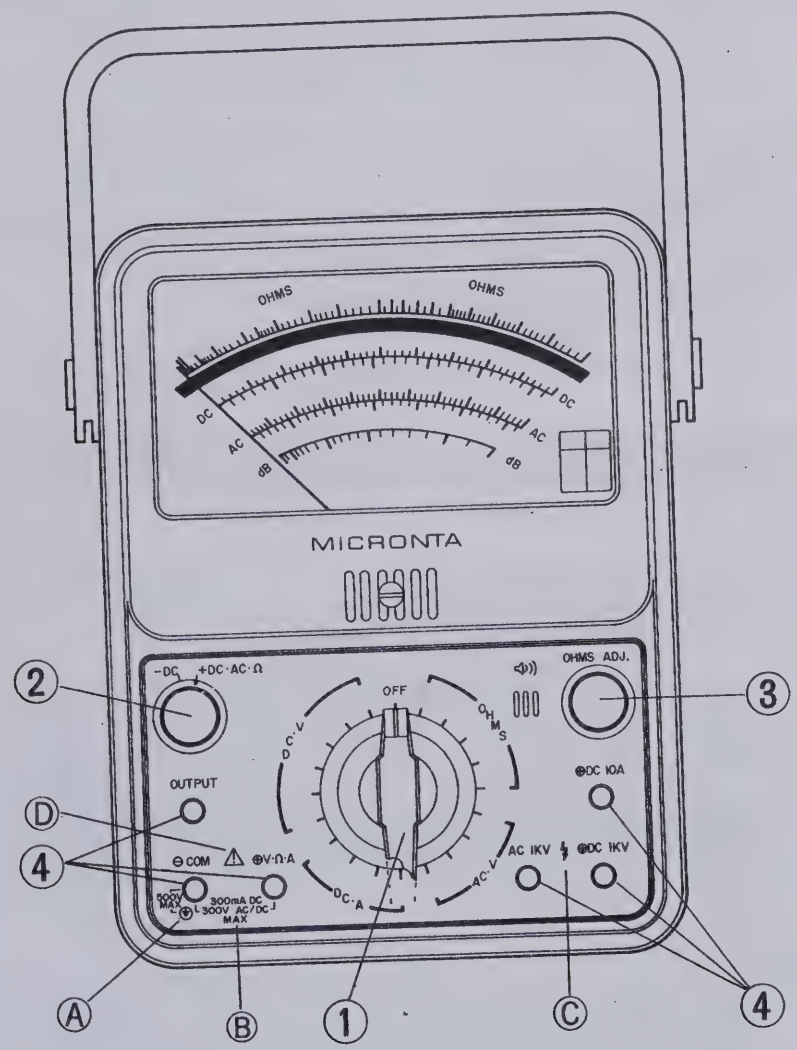

EXPLANATION OF CONTROLS AND MARKINGS

1. **Range Switch** – use the position that will result in a meter reading in the upper 1/3rd of the scale.

2. **–DC/+DC·AC·Ω** – is the polarity reverse switch. Set to **+DC·AC·Ω** when measuring all but **"–DC"** currents and voltages.

3. **OHMS ADJ** – use this control to set meter reading to "0" on the green OHMS scale when using the resistance function (with meter probes connected together).

4. **Jacks** – use ⊖ **COM** and ⊕ **V-Ω-A** unless you are measuring high DC or AC voltages. When measuring DC or AC voltages of 300-1000 volts, use ⊖ **COM** together with ⊕ DC 1KV or AC 1KV. For DC currents of 300 milliamperes up to 10 ampers, use the ⊕ DC 10A jack together with the ⊖ **COM** jack.

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B 300mA DC 300V AC/DC MAX The maximum voltage or current that can be measured is 300V AC/DC, or 300mA DC.

C. ϟ Be extra careful when making measurements for high voltage; do not touch terminals or probe ends.

D. ⚠ Refer to complete operating instructions.

USING YOUR MULTITESTER

You'll need one 9-volt battery for R x 10K and CONT. Ranges, and one "C" cell for the other resistance ranges. We recommend our 23-583/553 for 9V, 23-581/551 for "C".
Remove the Battery/Fuse Compartment Cover on the rear by loosening the screw and install batteries in the correct Compartment. Be sure to observe proper polarity. Replace Compartment Cover.

For most accurate readings, keep the meter laying flat on a non-metallic surface.
Also, use a Range setting that results in a reading in the upper 1/3rd of the meter scale.

Also, look at the scale from the point where the pointer and its reflection on the mirror come together: otherwise a reading error due to parallax will result.

If the pointer does not normally rest exactly over "0" at the left side of the scale, adjust the plastic screw in the lower center of the meter face to bring the needle to "0".

Always observe correct test lead polarity when making DC measurements: Black into ⊖ **COM** and Red into the ⊕ **V-Ω-A** (or ⊕ **DC 1KV** or **AC 1KV** or ⊕ **DC 10A**) jacks.
The maximum input limit for voltage and current measurement between ⊕ **V-Ω-A** and ⊖ **COM** is 300V AC/DC and 300mA DC.

TEST LEADS

Use only the same type of test leads as are supplied with your unit. These test leads are rated for 1000 volts; replacements are available from your local Radio Shack store.

DC VOLTAGE MEASUREMENTS

WARNING ! : USE EXTREME CARE WHEN MAKING MEASUREMENTS FOR HIGH VOLTAGE. DO NOT TOUCH TERMINAL OR PROBE ENDS.

1. Plug the test leads into the correct jacks – Black into ⊖ **COM** and Red into ⊕ **V-Ω-A**.
2. Set Range Selector to one of the **DCV** positions; it is best to start at the top and work down. Set the polarity-reversal switch to **+DC·AC·Ω**.
3. Connect the test probe tips to the circuit under test. If the meter reads backwards, set the polarity-reversal switch to **–DC**.
4. Set Range Selector as required to obtain a meter reading in the upper 1/3rd of the meter scale.
5. Read the voltage on the black DC scales.
6. For voltages between 300 and 1000 volts, plug the Red test lead into the ⊕ **DC 1 KV** jack. **Use extreme care when using this high-voltage range.**
   NOTE: The ⊕ **DC 1 KV** jack is for use only with DC voltages of 300 to 1000 volts.

AC VOLTAGE MEASUREMENTS

WARNING ! : USE EXTREME CARE WHEN MAKING MEASUREMENTS FOR HIGH VOLTAGE. DO NOT TOUCH TERMINAL OR PROBE ENDS.

1. Plug the test leads into the correct jacks – Black into ⊖ **COM** and Red into ⊕ **V-Ω-A**.
2. Set Range Selector to one of the **ACV** positions; it is best to start at the top and work down. Set the polarity-reversal switch to **+DC·AC·Ω**.
3. Connect the test probe tips to the circuit under test. Set Range Selector as required to give a meter reading in the upper 1/3rd of the meter scale.
4. Read the voltage on the red **AC** scale.

5. For voltages between 300 and 1000 volts, plug the Red test lead into the **AC 1KV** jack. **Use extreme care when using this high-voltage range.**

NOTE: The **AC 1KV** jack is for use only with AC voltages of 300 to 1000 volts.

DC CURRENT MEASUREMENTS

WARNING: DO NOT APPLY VOLTAGE TO MEASURING TERMINAL WHILE RANGE SWITCH IS IN CURRENT POSITION.

1. Plug the test leads into the correct jacks — Black into ⊖ **COM** and Red into ⊕ **V-Ω-A.**
2. Set Range Selector to the 300m (10A) **DC A** position. Set the polarity-reversal switch to **+DC·AC·Ω.**
3. Open up the circuit in which you want to measure current and connect the Black test probe to the negative side and the Red to the positive side of the circuit.
4. Apply power to the circuit under test. Set Range Selector to a position which will give a meter reading in the upper 1/3rd of the scale. Read current on the black DC scale.
   If the meter reads backwards, set polarity-reversal switch to — **DC.**

NOTE: Do not attempt to read AC current.

NOTE: If the current will be greater than 300 milliamps, plug the Red test lead into the ⊕ **DC 10A** jack.

RESISTANCE MEASUREMENTS

WARNING: DO NOT APPLY VOLTAGE TO MEASURING TERMINALS WHILE RANGE SWITCH IS IN OHMS POSITION.

Before taking any resistance measurements, disconnect power to the unit under test and discharge capacitors. It is best to remove batteries and unplug line cords.

1. Plug the test leads into the proper jacks — Black to ⊖ **COM** and Red to ⊕ **V-Ω-A.** Set polarity-reversal switch to **+DC·AC·Ω.**
2. Set Range Selector to one of the **OHMS** positions; touch the probe tips together and adjust **OHMS ADJ.** control to bring the pointer to the "0" on the top OHMS scale (green).
3. Now, connect the probe tips across the circuit or part under test. When measuring resistance, it is best to disconnect one side of the part under test (thus the remainder of the circuit will not interfere with the reading).
4. Read the resistance on the green OHMS scale; use the proper multiplier to obtain the correct value (R "times" 1, 10, 1,000, 10,000 depending on the position of the Range Selector).
5. CONT. position is for continuity checking. When resistance is 0 to 300 ohms, the built-in buzzer sounds. The level of sound reduces as the resistance increases.

NOTES: When you are unable to adjust the pointer to "0" on the OHMS scale in the R x 1, R x 10 or R x 1K position, the 1.5-volt C cell battery must be replaced.

When you are unable to adjust the pointer to "0" on the OHMS scale in the R x 10K position, or the continuity buzzer does not sound in the CONT. position when leads are shorted, the 9-volt battery must be replaced.

The polarity-reversal switch must be left in the **+DC·AC·Ω** position for all resistance measurements.

DECIBEL MEASUREMENTS

1. Plug the test leads into the proper jacks — Black into ⊖ **COM** and Red into ⊕ **V-Ω-A**.
2. Set Range Switch to one of the **ACV** positions; use a range that provides a meter reading in the upper 1/2 of the meter scale.
3. Read dB on the dB scale, adding the appropriate number of dB to the dB scale reading as noted in the chart at the lower right of the meter face.

NOTE: For absolute dB measurements, circuit impedance must be 600 ohms. 0 dB = 1 milliwatt dissipated in a 600 ohm impedance (equivalent to 0.775 volts across 600 ohms).

OUTPUT VOLTAGE MEASUREMENT

1. To measure AC voltage in the presence of DC voltage, use the OUTPUT function. Connect the Black lead to the ⊖ **COM** jack and the Red lead to the **OUTPUT** jack.
2. Set Function switch to **+DC·AC·Ω** position.
3. Set the Range switch to an **AC V** position and measure the voltage in the circuit.

NOTE: The function incorporates a DC blocking capacitor, rated at 600 volts.
Thus, do not exceed the 600 volts rating when measuring output voltage.

4. Read output voltages on the same scale as for AC voltage.

REPLACEMENT OF BATTERY/FUSE

WARNING: TO AVOID ELECTRIC SHOCK, DISCONNECT MEASURING TERMINALS BEFORE REMOVING BATTERY OR FUSE. REPLACE ONLY WITH SAME TYPE BATTERY OR FUSE. THIS INSTRUMENT CONTAINS NO USER SERVICEABLE PARTS.
SCREW REMOVAL BY QUALIFIED PERSONS ONLY.
CAUTION: FOR CONTINUED PROTECTION AGAINST FIRE, REPLACE ONLY WITH 0.5A, 250V FUSE.

To install or replace the Batteries/Fuse, loosen the screw on Battery/Fuse Compartment Cover to open.

NOTE: The fuse will blow when voltage is applied in resistance or current mode. In this case there will be no meter movement (Replace the fuse).

1. Disconnect the test leads.
2. Open the Battery/Fuse Compartment Cover.
3. Pull the red ribbon in the Fuse Compartment. The fuse will pop out.
4. Insert a new fuse on the ribbon ring. Use only a fuse of the same type/rating (0.5A, 250V).
5. Install fuse with ribbon in the Fuse Compartment.
6. Close the Battery/Fuse Compartment Cover.

WARNING: DO NOT OPERATE THE UNIT UNTIL THE BATTERY COVER IS IN PLACE AND FULLY CLOSED.

GOOD METER MEASUREMENT PRACTICES

There are some good general rules which apply to the use of electrical meters. Some are common-sense, some are safety precautions and some are just plain good habits to get into.

1. **CAUTION.** There is always the possibility of dangerous voltages being present in any piece of electrical/-electronic equipment. Always use extreme caution when making measurements — high voltage may appear at unexpected points in a suspected defective circuit.

2. When making measurements, never stand on a wet or damp floor. Do not work near (or on) any grounded metal object — for example, a metal work table, metal water or gas pipes, metal electrical conduit. Accidental contact between the grounded metal object and the circuit under test can be lethal.

3. Always use only well insulated test leads. Never use test leads without insulated test prods. Never allow your fingers to touch the bare metal part of the test probes (or circuit points).

4. Never use test leads with frayed or broken insulation; voltages will appear at all exposed contact points on the leads.

5. Never attempt to measure voltages or currents above the specified maximum the meter is designed for; refer to Specifications section (Page 3).

6. For safety's sake, disconnect leads as soon as you've completed measurements.

7. Always turn off the unit's power before connecting test leads. This is especially true when working on circuits with 100 or more volts.

8. Get into the habit of keeping one hand in your pocket when trouble-shooting any equipment containing high voltage circuitry.

9. You should remember that even a small shock can be dangerous, for your body's reaction to a minor shock can cause you to bump or fall against a higher voltage contact.

10. Discharge filter capacitors before connecting test leads; such capacitors can retain hazardous charges in units with high voltage circuits.

11. When making voltage and current measurements always start with the highest range available.

12. Never attempt to measure a voltage when the function is set to resistance or current (it may burn out the meter movement or other circuitry). Never attempt to measure current with the meter set for resistance.

13. Never attempt to measure AC voltages or current with the meter set to a DC mode (meter circuitry can be damaged).

14. Do not attempt to measure RF voltages with the Meter (it can be damaged, or at best the readings will be meaningless).

15. Do not expose your meter to moisture; avoid high humidity and excessive dust and dirt.

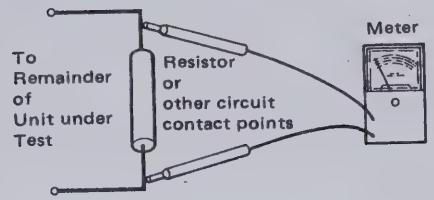
16. Avoid vibration or mechnical shock; the meter might be damaged or its accuracy affected.

17. Avoid using meters in locations with high magnetic fields (inaccurate measurements can result).

18. Remember that voltage and resistance measurements are made with the Meter connected in parallel. Current measurements are made with the meter connected in series.

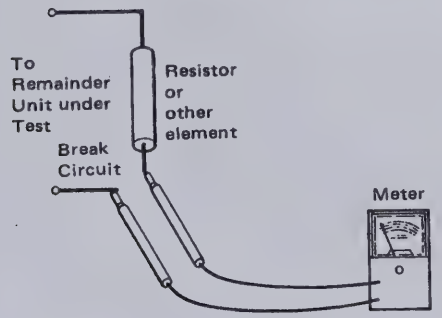
PARALLEL METER CONNECTION

For Voltage and Resistance measurements

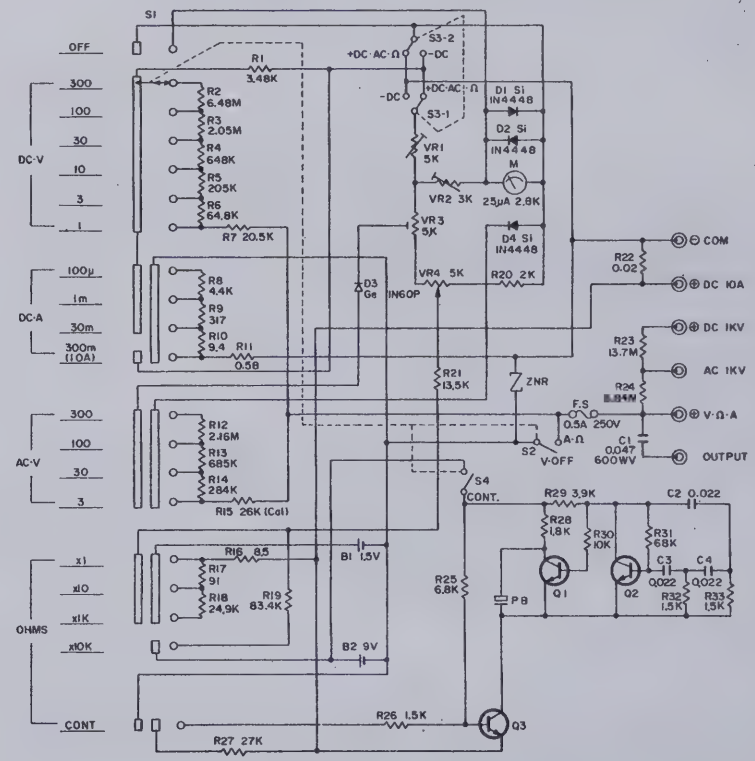


SERIES METER CONNECTION

For Current measurements



SCHEMATIC DIAGRAM



Q1, 2, 3 :
2SC1815 (Y, GR) or
2SC536 (F, G, H) or
KTN5014 (Y, GR, BL) or
MPS9532 (I, J, K, L)

NOTE
(1) ALL RESISTANCE VALUES ARE INDICATED IN "OHM" (K = 10^3 OHM M = 10^6 OHM)
(2) ALL CAPACITANCE VALUES ARE INDICATED IN "μF"

RADIO SHACK LIMITED WARRANTY

This equipment is warranteed against defects for 90 days from date of purchase. Within this period, we will repair it without charge for parts and labor. Simply **bring your sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover equipment subjected to misuse or accidental damage.

This Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

We Service What We Sell

RADIO SHACK A DIVISION OF TANDY CORPORATION

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Printed in Korea

MICRONTA®

FET – VOM

INSTRUCTION MANUAL

Catalog Number 22-208

CUSTOM MANUFACTURED FOR

RADIO SHACK A DIVISION OF TANDY CORPORATION

IMPORTANT

SCAN THIS TYPE/SIZE MANUALLY!

PUT CENTER OF PAGE AT THE PENCIL MARK ON THE SCANNER WINDOW

MICRONTA®

FET – VOM

INSTRUCTION MANUAL

Catalog Number 22-208

CUSTOM MANUFACTURED FOR

RADIO SHACK A DIVISION OF TANDY CORPORATION

Your **MICRONTA FET VOM** has all the advantages of a VTVM, with the portability of a VOM. A dual-Field Effect Transistor provides the high input impedance, with circuit stability that rivals the finest VTVMs.

Power is provided by 2 batteries — a 1½-volt type "C" for the Resistance function and a standard 9-volt rectangular type for the FET Amplifier.

Ranges are set up as convenient multiples of 1 and 3. With the high-sensitivity 300 millivolt full-scale DC voltage range, you can measure down to 10 millivolts of DC voltage (+ or —). The 100 microamp DC current range will let you measure DC currents down as low as just a few microamperes. AC Voltages and DB functions combine to provide great versatility at low AC signal levels (down to about 1/10th of a volt).

The DC polarity switch makes it convenient to check DC voltages without switching leads for opposite polarity. A front panel Battery Check switch assures accurate readings because you know when the 9-volt battery is beginning to weaken.

47" (120 cm) well-insulated test leads with spring-steel bananna-type plugs result in firm, safe, low-resistance circuit connections.

The large 5" (12 cm) color-coded meter scale incorporates a mirrored scale to eliminate parallax reading errors.

Your FET VOM is ideally suited for service, engineering, lab, hobby or class-room use — rugged in construction — portable and accurate. The meter movement is automatically protected from excess circuit current/voltage damage.

SPECIFICATIONS:

METER : 5", 25μA 3-color, mirrored scale
DC VOLTAGE : 8 Ranges
0.3-1-3-10-30-100-300-1000V
Input impedance; 10 megohm (1000 V range is 32 megohms)
Accuracy ; ±3% full scale
AC VOLTAGE : 5 Ranges
3-30-100-300-1000 V
Input impedance ; 10KΩ/volt
Accuracy ; ±4% full scale

DC CURRENT : 5 Ranges
100μ-3m-30m-300mA-10A
Terminal Voltage ; 316 mV
Accuracy ; ±3% full scale

RESISTANCE : 5 Ranges
Rx1-Rx10-Rx1K-Rx10K-Rx1M (center scale 10)
Rx1 ; 0-1K
Rx10 ; 0-10K
Rx1K ; 0-1M
Rx10K ; 0-10M
Rx1M ; 0-1000M
Accuracy ; ±3% of scale-length

ACCESSORIES
Test Leads ; 47"(120 cm) spring-steel, banana plug style
BATTERIES: Requires one type "C" battery and one 9-volt rectangular type

SIZE: 7" x 5½" x 3-1/8" (18×14×8 cm) (HWD)
WEIGHT: 1.76 lbs (800g)

DESCRIPTION OF CONTROLS

ZERO ADJ. – use this control to balance the internal circuitry to obtain "0" reading when the FET VOM is ON.

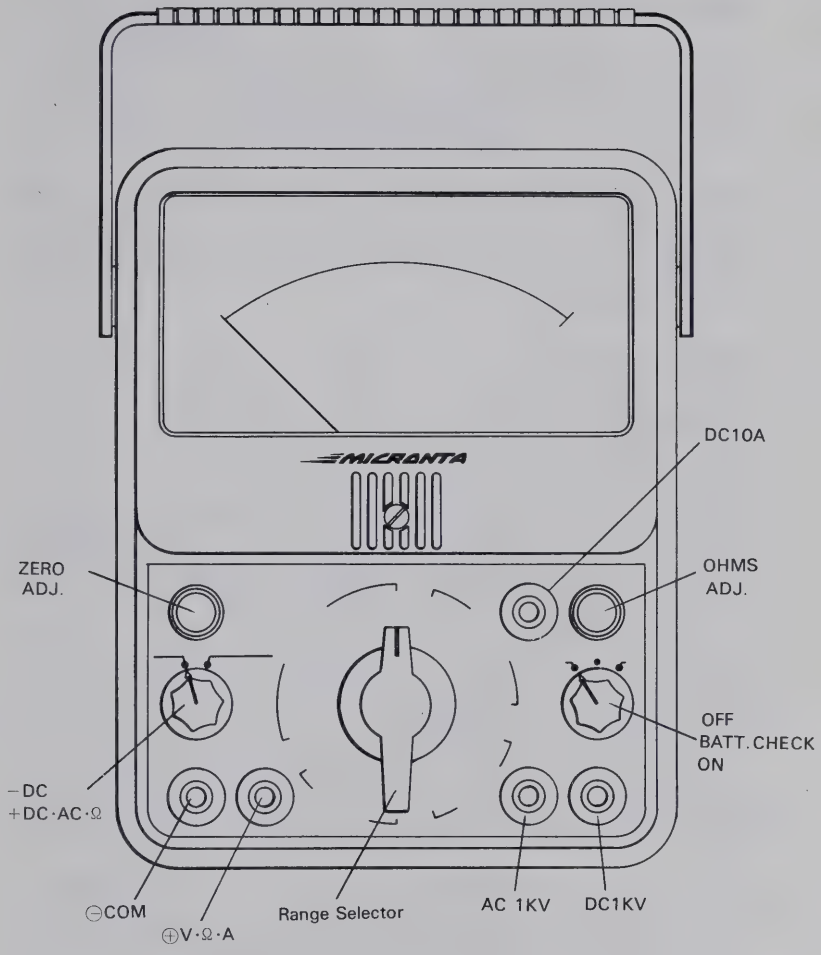
–DC/+DC, AC, Ω – is the polarity reverse switch. Set to +DC, AC, Ω when measuring all but "–DC" currents and voltages.

Range Selector – use the position that will result in a meter reading in the upper 1/3rd of the scale.

OHMS ADJ. – use this control to set meter reading to "0" on the green OHMS scale when using the resistance function (with meter probes connected together).

OFF/BATT. CHECK/ON – use to turn the FET VOM "on" or to check condition of the 9-volt battery. When not in use, leave in the OFF position.

Jacks – use ⊖ COM and ⊕ V · Ω · A unless you are measuring high DC or AC voltages. When measuring DC or AC voltages of 300-1000 volts, use ⊖ COM together with DC 1KV or AC 1KV. For DC currents of 300 miliamperes upto 10 amperes, use the 10A DC jack together with the ⊖ COM jack.


MICRONTA
DC10A
ZERO
ADJ.
OHMS
ADJ.
OFF
BATT. CHECK
ON
−DC
+DC·AC·Ω
⊖COM
⊕V·Ω·A
Range Selector
AC 1KV
DC1KV

BEFORE YOU USE YOUR FET VOM

Remove the case back and install the batteries; take care to observe proper polarity as indicated on the battery compartments. Replace the case back.

When unit is OFF, if the pointer does not normally rest exactly over the O's at the left side of the scale, adjust the plastic screw in the lower center of the meter face to bring the needle to "0".

Check meter zero balance when you first turn the FET VOM "on". The pointer should rest directly over the 0 at the extreme left end of the scale (be sure the mechanical zero adjustment has been set as noted in the above paragraph). Now, set Range Selector to .3 DC V, plug in test leads, short test probe tips together and switch the polarity reverse switch back and forth – adjust ZERO ADJ. so the pointer rests exactly over the left hand 0 (in either position of the polarity reverse switch).

Check condition of the 9-volt battery by using the BATT. CHECK position; as long as the pointer gives an indication up to the "BATTERY OK" point on the meter, the 9-volt battery is OK. If reading is below that point, replace the 9-volt battery. We recommend Radio Shack's Catalog Number 23-583, or 23-553 for extra-long-life.

For most accurate readings, keep the meter laying flat on a non-metallic surface. Also, use a Range position that results in a meter reading in the upper 1/3rd of the meter scale.

Always observe correct test lead polarity when making DC measurements; the polarity-reverse switch is provided to permit you to make quick polarity changes.

Exercise extreme caution when measuring voltages of 150 and above.

When not in use, or when moving your Instrument, leave ON/OFF switch in the **OFF** position.

USING YOUR FET VOM

DC VOLTAGE MEASUREMENTS

1. Plug the test leads into the correct jacks — Black into ⊖ **COM** and Red into ⊕ **V · Ω · A.**
2. Set Range Selector to one of the DCV positions; it is best to start at the top and work down. Set the polarity-reversal switch to + **DC, AC, Ω.**
3. Connect the test probe tips to the circuit under test. If the meter reads backwards, set the polarity-reversal switch to — **DC.**
4. Set Range Selector as required to obtain a meter reading in the upper 1/3rd of the meter scale.
5. Read the voltage on the **black** DC scales.
6. For voltages between 300 and 1000 volts, plug the Red test lead into the **DC 1KV** jack. **Use extreme care when using this high-voltage range.**
   NOTE: The **DC 1KV** jack is for use only with DC voltages of 300 to 1000 volts.

AC VOLTAGE MEASUREMENTS

1. Plug the test leads into the correct jacks — Black into ⊖ **COM** and Red into ⊕ **V · Ω · A.**
2. Set Range Selector to one of the **ACV** positions; it is best to start at the top and work down. Set the polarity-reversal switch to + **DC · AC · Ω.**
3. Connect the test probe tips to the circuit under test. Set Range Selector as required to give a meter reading in the upper 1/3rd of the meter scale.
4. Read the voltage on the red **AC** scale.
5. For voltages between 300 and 1000 volts, plug the Red test lead into the **AC 1KV** jack. **Use extreme care when using this high-voltage range.**

NOTE: The **AC 1KV** jack is for use only with AC voltages of 300 to 1000 volts.

DC CURRENT MEASUREMENTS

1. Plug the test leads into the correct jacks — Black into ⊖ **COM** and Red into ⊕ **V · Ω · A.**
2. Set Range Selector to the 300 m /10A DC A position. Set the polarity-reversal switch to + **DC · AC · Ω.**
3. Open up the circuit in which you want to measure current and connect the Black test probe to the negative side and the Red to the positive side of the circuit.
4. Apply power to the circuit under test. Set Range Selector to a position which will give a meter reading in the upper 1/3rd of the scale. Read current on the black DC scale.

   If the meter reads backwards, set polarity-reversal switch to — DC.

NOTE: Do not attempt to read AC current.

NOTE: If the current will be greater than 300 milliamps, plug the Red test lead into the DC 10A jack.

RESISTANCE MEASUREMENTS

> Before taking any resistance measurements, disconnect power to the unit under test and discharge capacitors. It is best to remove batteries and unplug line cords.

1. Plug the test leads into the proper jacks — Black to ⊖ **COM** and Red to ⊕ **V · Ω · A.** Set polarity-reversal switch to **+ DC · AC · Ω.**
2. Set Range Selector to one of the OHMS positions; touch the probe tips together and adjust **OHMS ADJ.** control to bring the pointer to the "0" on the top OHMS scale (green).
3. Now, connect the probe tips across the circuit or part under test. When measuring resistance, it is best to disconnect one side of the part under test (thus the remainder of the circuit will not interfere with the reading).
4. Read the resistance on the green OHMS scale; use the proper multiplier to obtain the correct value (R "times" 1, 10, 1,000, 10,000 or 1,000,000, depending on the position of the Range Selector).

NOTES: When you are unable to adjust the pointer to "0" on the OHMS scale in any OHMS position, the 1.5-volt C cell battery must be replaced.

The polarity-reversal switch must be left in the **+ DC · AC · Ω** position for all resistance measurements.

DECIBEL MEASUREMENTS

1. Plug the test leads into the proper jacks — Black into ⊖ **COM** and Red into ⊕ **V · Ω · A.**

2. Set Range Selector to one of the ACV positions; use a range that provides a meter reading in the upper 1/3rd of the meter scale.
3. Read dB on the dB scale, adding the appropriate number of dB to the dB scale reading as noted in the chart at the lower right of the meter face.

NOTE: For absolute dB measurements, circuit impedance must be 600 ohms. 0 dB=1 milliwatt dissipated in a 600 ohm impedance (equivalent to 0.775 volts across 600 ohms).

For additional ideas and information on how to use your Instrument, we suggest you obtain a copy of Radio Shack's book REALISTIC GUIDE TO VOM'S AND VTVM'S.

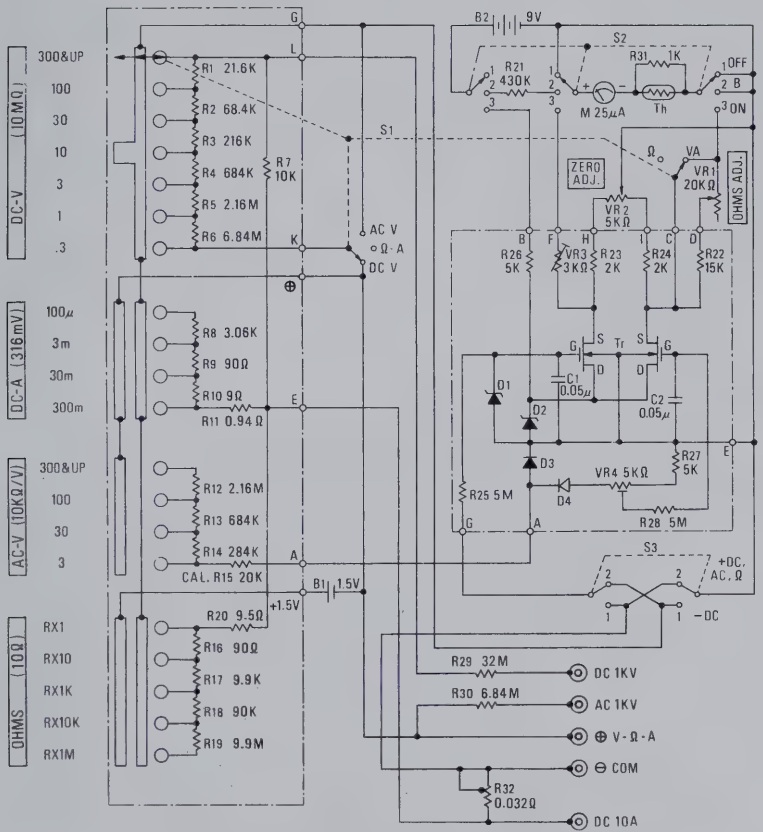
MAINTENANCE

Your FET VOM is ruggedly constructed and the meter movement is automatically protected from voltage or current overloads. Thus, your Instrument should require little or no service or repair – providing you treat it with a normal amount of respect. Don't subject your unit to excessive shock or measuring abuse.

Periodically check the condition of the 9-volt battery. When using the BATT. CHECK switch, the meter pointer should read above the BATT. OK line. If not, replace the 9-volt battery. We recommend Radio Shack's Catalog Number 23-583 or 23-553 for extra-long-life.

If you can no longer "zero" the meter reading on an OHMS range, with the probes shorted together, it's time to replace the 1½-volt C battery. We recommend Catalog Number 23-581, or 23-551 for extra-long-life.

SCHEMATIC DIAGRAM



NOTE : Resistance values are indicated in ohms unless otherwise specified (K=1,000 ohms and M=megohms). Capacitance values are shown in microfarads unless otherwise noted (P=micro-microfarads).

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The DC polarity switch makes it convenient to check DC voltages without switching leads for opposite polarity. A front panel Battery Check switch assures accurate readings because you know when the 9-volt battery is beginning to weaken.

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SPECIFICATIONS:

METER : 5", 25μA 3-color, mirrored scale
DC VOLTAGE : 8 Ranges
0.3-1-3-10-30-100-300-1000V
Input impedance; 10 megohm (1000 V range is 32 megohms)
Accuracy ; ±3% full scale
AC VOLTAGE : 5 Ranges
3-30-100-300-1000 V
Input impedance ; 10KΩ/volt
Accuracy ; ±4% full scale

DC CURRENT : 5 Ranges
100μ-3m-30m-300mA-10A
Terminal Voltage ; 316 mV
Accuracy ; ±3% full scale

RESISTANCE : 5 Ranges
Rx1-Rx10-Rx1K-Rx10K-Rx1M (center scale 10)
Rx1 ; 0-1K
Rx10 ; 0-10K
Rx1K ; 0-1M
Rx10K ; 0-10M
Rx1M ; 0-1000M
Accuracy ; ±3% of scale-length

ACCESSORIES
Test Leads ; 47"(120 cm) spring-steel, banana plug style
BATTERIES: Requires one type "C" battery and one 9-volt rectangular type

SIZE: 7" x 5½" x 3-1/8" (18×14×8 cm) (HWD)
WEIGHT: 1.76 lbs (800g)

DESCRIPTION OF CONTROLS

ZERO ADJ. – use this control to balance the internal circuitry to obtain "0" reading when the FET VOM is ON.

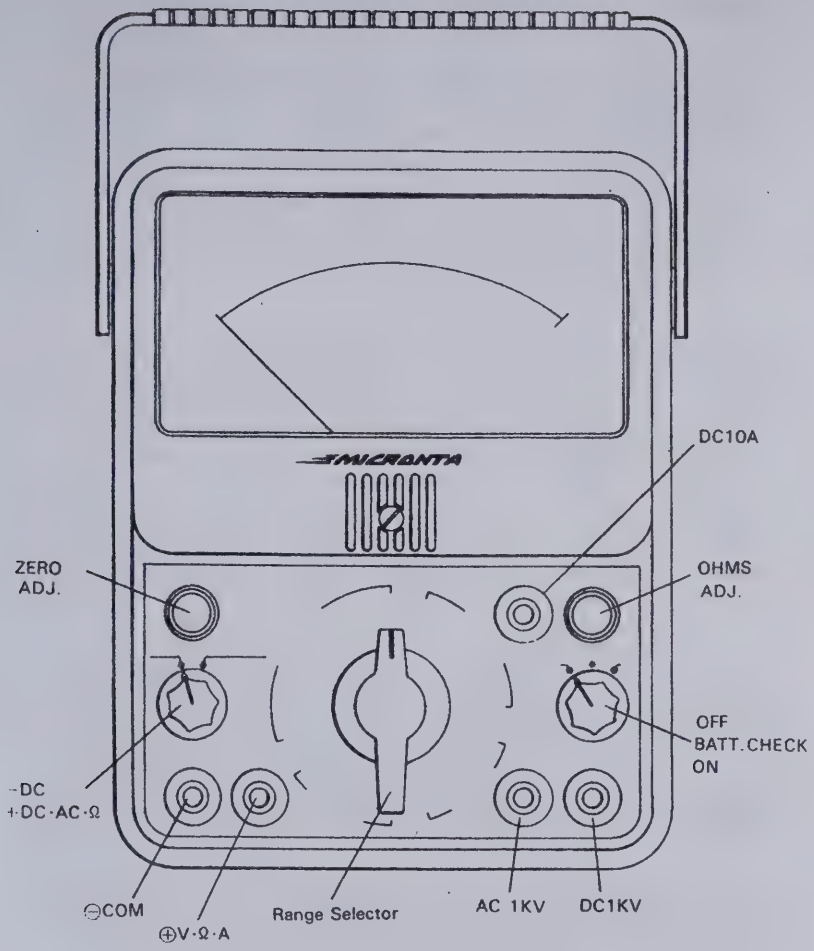
–DC/+DC, AC, Ω – is the polarity reverse switch. Set to +DC, AC, Ω when measuring all but "–DC" currents and voltages.

Range Selector – use the position that will result in a meter reading in the upper 1/3rd of the scale.

OHMS ADJ. – use this control to set meter reading to "0" on the green OHMS scale when using the resistance function (with meter probes connected together).

OFF/BATT. CHECK/ON – use to turn the FET VOM "on" or to check condition of the 9-volt battery. When not in use, leave in the OFF position.

Jacks – use ⊖COM and +V·Ω·A unless you are measuring high DC or AC voltages. When measuring DC or AC voltages of 300-1000 volts, use ⊖COM together with DC 1KV or AC 1KV. For DC currents of 300 miliamperes upto 10 amperes, use the 10A DC jack together with the ⊖COM jack.


DC10A
ZERO
ADJ.
OHMS
ADJ.
OFF
BATT.CHECK
ON
-DC
+DC·AC·Ω
⊖COM
⊕V·Ω·A
Range Selector
AC 1KV
DC1KV

BEFORE YOU USE YOUR FET VOM

Remove the case back and install the batteries; take care to observe proper polarity as indicated on the battery compartments. Replace the case back.

When unit is OFF, if the pointer does not normally rest exactly over the O's at the left side of the scale, adjust the plastic screw in the lower center of the meter face to bring the needle to "0".

Check meter zero balance when you first turn the FET VOM "on". The pointer should rest directly over the 0 at the extreme left end of the scale (be sure the mechanical zero adjustment has been set as noted in the above paragraph). Now, set Range Selector to .3 DC V, plug in test leads, short test probe tips together and switch the polarity reverse switch back and forth – adjust ZERO ADJ. so the pointer rests exactly over the left hand 0 (in either position of the polarity reverse switch).

Check condition of the 9-volt battery by using the BATT. CHECK position; as long as the pointer gives an indication up to the "BATTERY OK" point on the meter, the 9-volt battery is OK. If reading is below that point, replace the 9-volt battery. We recommend Radio Shack's Catalog Number 23-583, or 23-553 for extra-long-life.

For most accurate readings, keep the meter laying flat on a non-metallic surface. Also, use a Range position that results in a meter reading in the upper 1/3rd of the meter scale.

Always observe correct test lead polarity when making DC measurements; the polarity-reverse switch is provided to permit you to make quick polarity changes.

Exercise extreme caution when measuring voltages of 150 and above.

When not in use, or when moving your Instrument, leave ON/OFF switch in the **OFF** position.

USING YOUR FET VOM

DC VOLTAGE MEASUREMENTS

1. Plug the test leads into the correct jacks — Black into ⊖ **COM** and Red into ⊕ **V · Ω · A.**
2. Set Range Selector to one of the DCV positions; it is best to start at the top and work down. Set the polarity-reversal switch to **+ DC, AC, Ω.**
3. Connect the test probe tips to the circuit under test. If the meter reads backwards, set the polarity-reversal switch to **— DC.**
4. Set Range Selector as required to obtain a meter reading in the upper 1/3rd of the meter scale.
5. Read the voltage on the **black** DC scales.
6. For voltages between 300 and 1000 volts, plug the Red test lead into the **DC 1KV** jack. **Use extreme care when using this high-voltage range.**
   NOTE: The **DC 1KV** jack is for use only with DC voltages of 300 to 1000 volts.

AC VOLTAGE MEASUREMENTS

1. Plug the test leads into the correct jacks – Black into ⊖ **COM** and Red into ⊕ **V · Ω · A.**
2. Set Range Selector to one of the **ACV** positions; it is best to start at the top and work down. Set the polarity-reversal switch to + **DC · AC · Ω.**
3. Connect the test probe tips to the circuit under test. Set Range Selector as required to give a meter reading in the upper 1/3rd of the meter scale.
4. Read the voltage on the red **AC** scale.
5. For voltages between 300 and 1000 volts, plug the Red test lead into the **AC 1KV** jack. **Use extreme care when using this high-voltage range.**

NOTE: The **AC 1KV** jack is for use only with AC voltages of 300 to 1000 volts.

DC CURRENT MEASUREMENTS

1. Plug the test leads into the correct jacks – Black into ⊖ **COM** and Red into ⊕ **V · Ω · A.**
2. Set Range Selector to the 300 m /10A DC A position. Set the polarity-reversal switch to + **DC · AC · Ω.**
3. Open up the circuit in which you want to measure current and connect the Black test probe to the negative side and the Red to the positive side of the circuit.
4. Apply power to the circuit under test. Set Range Selector to a position which will give a meter reading in the upper 1/3rd of the scale. Read current on the black DC scale.

   If the meter reads backwards, set polarity-reversal switch to – DC.

NOTE: Do not attempt to read AC current.

NOTE: If the current will be greater than 300 milliamps, plug the Red test lead into the DC 10A jack.

RESISTANCE MEASUREMENTS

> Before taking any resistance measurements, disconnect power to the unit under test and discharge capacitors. It is best to remove batteries and unplug line cords.

1. Plug the test leads into the proper jacks – Black to ⊖ COM and Red to ⊕ V · Ω · A. Set polarity-reversal switch to + DC · AC · Ω.
2. Set Range Selector to one of the OHMS positions; touch the probe tips together and adjust **OHMS ADJ.** control to bring the pointer to the "0" on the top OHMS scale (green).
3. Now, connect the probe tips across the circuit or part under test. When measuring resistance, it is best to disconnect one side of the part under test (thus the remainder of the circuit will not interfere with the reading).
4. Read the resistance on the green OHMS scale; use the proper multiplier to obtain the correct value (R "times" 1, 10, 1,000, 10,000 or 1,000,000, depending on the position of the Range Selector).

NOTES: When you are unable to adjust the pointer to "0" on the OHMS scale in any OHMS position, the 1.5-volt C cell battery must be replaced.

The polarity-reversal switch must be left in the + DC · AC · Ω position for all resistance measurements.

DECIBEL MEASUREMENTS

1. Plug the test leads into the proper jacks – Black into ⊖ COM and Red into ⊕ V · Ω · A.

2. Set Range Selector to one of the ACV positions; use a range that provides a meter reading in the upper 1/3rd of the meter scale.
3. Read dB on the dB scale, adding the appropriate number of dB to the dB scale reading as noted in the chart at the lower right of the meter face.

NOTE: For absolute dB measurements, circuit impedance must be 600 ohms. 0 dB=1 milliwatt dissipated in a 600 ohm impedance (equivalent to 0.775 volts across 600 ohms).

For additional ideas and information on how to use your Instrument, we suggest you obtain a copy of Radio Shack's book REALISTIC GUIDE TO VOM'S AND VTVM'S.

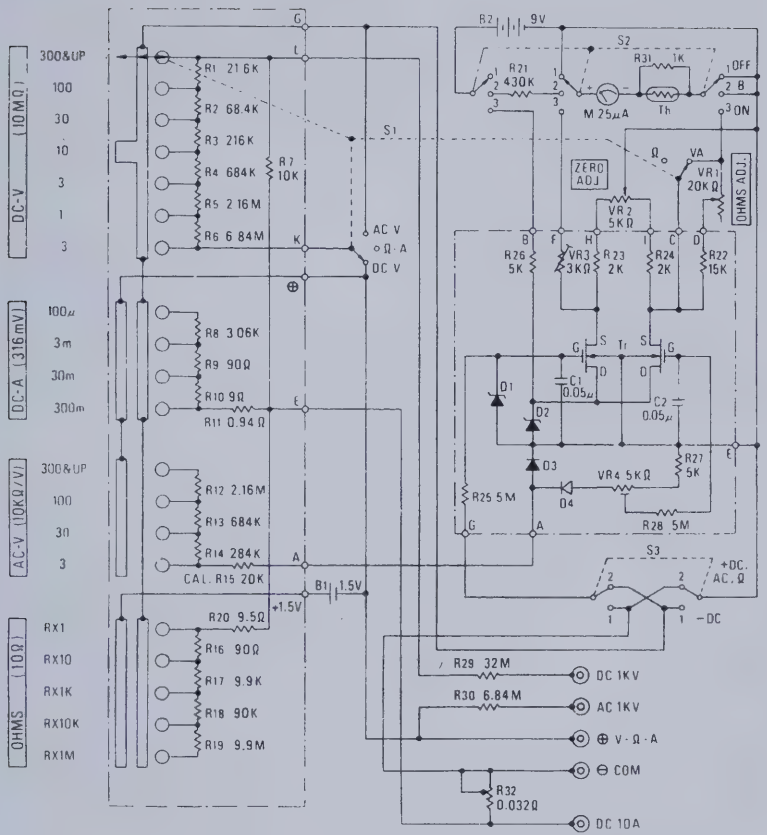
MAINTENANCE

Your FET VOM is ruggedly constructed and the meter movement is automatically protected from voltage or current overloads. Thus, your Instrument should require little or no service or repair – providing you treat it with a normal amount of respect. Don't subject your unit to excessive shock or measuring abuse.

Periodically check the condition of the 9-volt battery. When using the BATT. CHECK switch, the meter pointer should read above the BATT. OK line. If not, replace the 9-volt battery. We recommend Radio Shack's Catalog Number 23-583 or 23-553 for extra-long-life.

If you can no longer "zero" the meter reading on an OHMS range, with the probes shorted together, it's time to replace the 1½-volt C battery. We recommend Catalog Number 23-581, or 23-551 for extra-long-life.

SCHEMATIC DIAGRAM



NOTE : Resistance values are indicated in ohms unless otherwise specified (K=1,000 ohms and M=megohms). Capacitance values are shown in microfarads unless otherwise noted (P=micro-microfarads).

RADIO SHACK LIMITED WARRANTY

This equipment is warranteed against defects for 90 days from date of purchase. Within this period, we will repair it without charge for parts and labor. Simply **bring your sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover equipment subjected to misuse or accidental damage.

This Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

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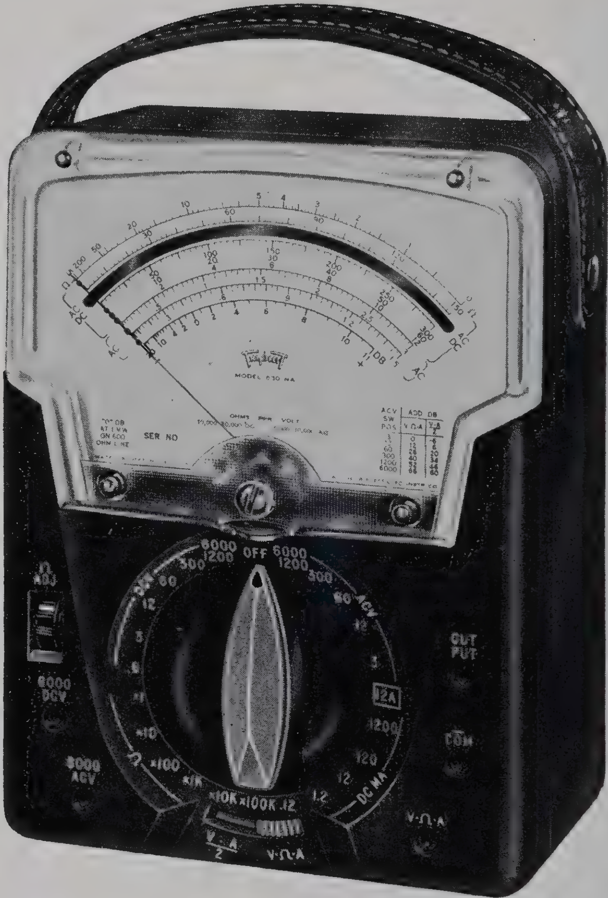
TRIPLETT

INSTRUCTION MANUAL

MODEL 630-NA TYPE 1
VOLT-OHM-MILLIAMMETER

TABLE OF CONTENTS

Printed in U.S.A. **Part No. 84-158**


MODEL 630 NA
SER NO
OFF
ACV
DC MA
OUT PUT
COM
V-Ω-A
6000 DCV
6000 ACV

Model 630-NA

16—D. C. VOLTS
0-0.240-0.6-3-12-60-300-1200-6000 at 10,000 Ohms/Volt except 0.240 range
0-0.120-0.3-1.5-6-30-150-600-3000 at 20,000 Ohms/Volt except 0.120 range

12—A. C. VOLTS
0-3-12-60-300-1200-6000 at 5,000 Ohms/Volt
0-1.5-6-30-150-600-3000 at 10,000 Ohms/Volt

12—DB —20 to +77

3—D. C. MICROAMPERES
0-60-600 at 120 M. V. 0-120 at 240 M. V.

7—D. C. MILLIAMPERES
0-6-60-600 at 120 M. V. 0-1.2-12-120-1200 at 240 M. V.

2—D. C. AMPERES 0-6 at 120 M. V. 0-12 at 240 M. V.

3—OHMS 0-1K-10K-100K (4.4-44-440 at center scale)

3—MEGOHMS
0-1-10-100 (4400-44,000-440,000 Ohms center scale)

12—OUTPUT On AC Volt ranges to 1200 V.

GENERAL DESCRIPTION

Accuracy ±1½% on all DC ranges except 3000 and 6000 volt ranges which are ±3½%. ±3% on all AC ranges (on 60 cps sine wave) except 3000 and 6000 volt ranges which are ±5%. ±1½% of DC scale with full battery on ohms. All accuracies are per cent of full scale at 77° F. For greatest accuracy, the instrument should be used in the horizontal position in the upper ½ of the scale.

Frequency Response AC Volts through 300 are compensated from 35 CPS to 20 KC.

Meter Protection Meter movement protected against heavy overload by use of germanium diodes.

Scale 4.5" long. AC and DC use same single scale with exception of 1.5 and 3 Volt AC. The single scale is made possible by the high efficiency of the rectifier. Mirror used to eliminate parallax.

Batteries packed separately. See page 25 for installation.

Test Leads One red and one black lead supplied, each 48" long. Two push-on type alligator clips supplied. Banana type plug for low resistance contact.

Accessories Four rubber feet are supplied to fit into four holes provided in the rear of the tester case.

Size 3-11/32" x 5½" x 7½". **Weight** Approx. 4 lbs.

FOREWORD

With your purchase of a Model 630-NA Volt-Ohm-Milliammeter, you have made a worth-while investment, not only in a fine instrument, but backed up by a company which has been making instruments for over a half century. The Triplett Company stands behind your 630-NA and will give all possible assistance in its use and maintenance.

TRIPLETT WARRANTY AND CONDITIONS OF SALE

The Triplett Electrical Instrument Company warrants instruments manufactured by it to be free from defective material or factory workmanship and agrees to repair or replace such instruments which under normal use and service, disclose the defect to be the fault of our manufacturing. Our obligation under this warranty is limited to repairing or replacing any instrument or test equipment which proves to be defective, when returned to us transportation prepaid within ninety (90) days from the date of original purchase .

This warranty does not apply to any of our products which have been repaired or altered by unauthorized persons or service stations in any way so as, in our judgment, to injure their stability or reliability or which have been subject to misuse, negligence or accident or which have had the serial number altered, effaced, or removed. Neither does this warranty apply to any of our products which have been connected, installed, or adjusted otherwise than in accordance with the instructions furnished by us. Accessories including all vacuum tubes and batteries not of our manufacture used with this product are not covered by this warranty.

The Triplett Electrical Instrument Company reserves the right to discontinue models at any time, or change specifications or design, without notice and without incurring any obligation.

Upon acceptance of the material covered by this invoice the purchaser agrees to assume all liability for any damages and bodily injury which may result from the use or misuse of the material by the purchaser, his employees, or others, and that The Triplett Electrical Instrument Company shall incur no liability for direct or consequential damage of any kind.

Parts will be made available for a maximum period of five (5) years after the manufacture of this equipment has been discontinued. Parts include all materials, charts, instructions, diagrams, accessories, et cetera, which were furnished in the standard or special models.

This warranty and conditions of sale are in lieu of all others expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

The Triplett Electrical Instrument Company
Bluffton, Ohio

GENERAL DESCRIPTION AND FAMILIARIZATION

The model 630-NA is a combination multi-range measuring instrument offering several functions heretofore unavailable in the conventional Volt-Ohm-Milliammeter. This instrument was designed for those who require better accuracy, measurements over a multiplicity of ranges and frequencies together with greater dependability and simplicity of operations. The following notes may be helpful in understanding some of the new functions of this instrument.

For greater accuracy it is usually best to select a range such that the meter will read in the upper half of the scale. On the model 630-NA, all voltage and current ranges can be split in half by a simple slide switch located below the range knob, thus permitting best scale utilization. Splitting the range also changes the meter sensitivity so that loading effects in sensitive circuits can be observed. In these instances, the actual meter reading may differ when the range is split due to circuit loading. These readings should therefore be taken at the appropriate meter sensitivity.

The model 630-NA incorporates special germanium diodes to prevent damage to the meter movement on accidental overloads. Since most resistors will withstand quite severe instantaneous overloads, it is usually the meter movement that is damaged on overload in conventional multi-meters. Overloads of 1000 times have been applied to the meter movement of the model 630-NA without affecting accuracy.

Compensation of the AC voltage ranges over the audio range provides a new function for this type instrument. At the extreme high frequencies, some variation is to be expected by location of the test leads. Generally it is suggested the leads be kept as far from the chassis and high frequencies components as possible. Use of the alligator clips to clip the lead to the circuit when possible will avoid hand capacity effects.

High Voltage Power Caution: Where power source exceeds 18 watts do not use for higher voltage measurements — 6000 volts — 1200 volts.

Measuring DC Volts

Rotate the selector switch to the appropriate range for DC volts. Always start with the highest range if in doubt as to the approximate voltage. In choosing ranges, endeavor to have the readings fall in the upper, or right hand, half of the scale for greatest accuracy.

Plug the black test lead into the "COM" jack and the red lead into the V-Ω-A jack as shown on page 7.

CAUTION on DC Volts do not measure DC voltages having an AC component greater than 450 volts peak. Insulation is tested to withstand a maximum of 1650 rms volts.

Connect the test prods ACROSS the voltage source. The red lead is positive. Where polarity is difficult to determine, the meter may read backwards. No damage will be done if this occurs. Simply reverse the leads.

All DC ranges are read on the two black center scales; one directly above the mirror, the other just below the mirror.

With Slide Switch In V-Ω-A Position:

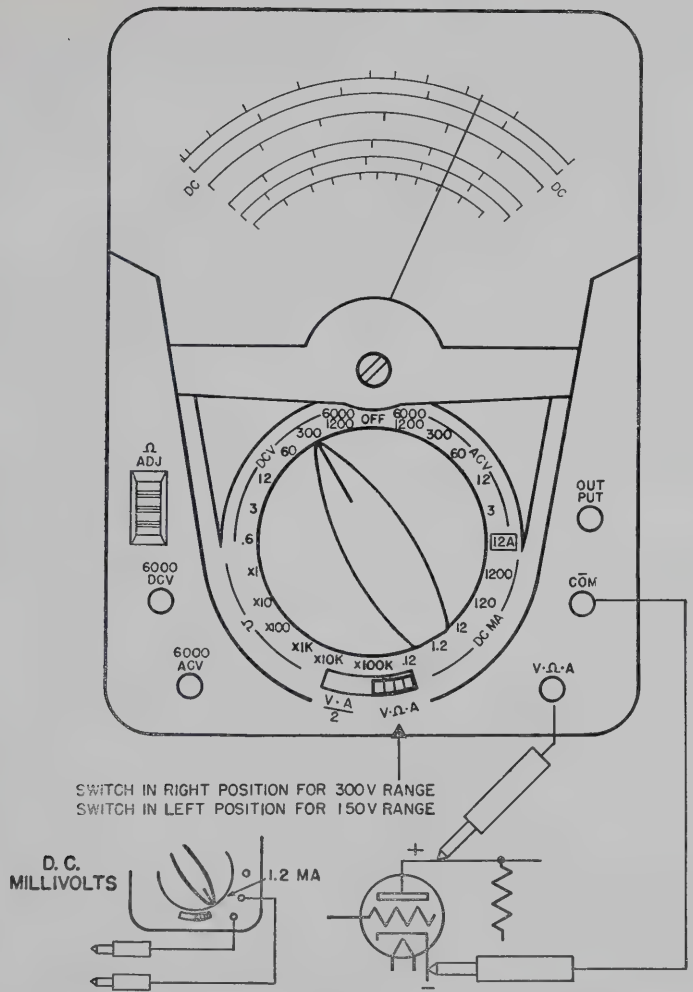
The full scale reading of the instrument is identical to that indicated by the large range switch knob. Thus with the range switch knob at 3 note that the 3 volt range is read on the 300 volt scale simply by dropping two zeros (i. e. dividing by 100). Other ranges are read similarly by adding or omitting zeros as required. The meter sensitivity is 10,000 ohms per volt with slide switch in V-Ω-A position.

With Slide Switch In $\frac{V \cdot A}{2}$ Position:

The instrument will read exactly half of the value indicated by the large range switch knob. Thus with the range knob set at 300, the meter actually will read 150. The scale immediately above the mirror is used for 0-150 volts. With the range switch knob set on 60, the meter will read 30 volts full scale. Read this on the 300 volt scale by dropping one zero (i e. dividing by 10). Other ranges are handled in a similar fashion. The meter sensitivity is 20,000 ohms per volt with the slide switch in $\frac{V \cdot A}{2}$ position.

In order to read D. C. millivolts, the full scale value will be 240 MV with the slide switch to the right and 120 MV with the slide switch to the left, when placing the knob of the selector switch in the .12 or 1.2 D. C. Ma ranges for either of the MV readings. Sensitivity will not be 10,000Ω/V and 20,000Ω/V at 240 MV and 120 MV respectively.

For handy operation chart see pages 16 and 17



CAUTION: For maximum safety do not handle tester or leads when connected to high voltages. Make certain that no condensers are charged by a high voltage.

Measuring AC Volts

Rotate the selector switch to the appropriate range for AC volts. Always start with the highest range if in doubt as to the approximate voltage.

In choosing ranges, endeavor to have the readings fall in the upper, or right hand, half of the scale for greatest accuracy.

Plug the black test lead into the "COM" jack and the red lead into the V-Ω-A jack as shown on page 9.

The AC range up to and including 300 volts is compensated for frequencies from 35 cps to 20 KC. Over this range an additional 5% accuracy should be allowed, primarily for the higher ranges and frequencies. The lower frequencies will exhibit negligible error.

CAUTION: When measuring up to 6000 volts, set the selector switch on the 6000/1200 range, plug the red lead into the jack marked "6000 ACV" and leave the black lead in the "COM" jack.

Connect the test probes ACROSS the voltage source. As there is no polarity on AC, the red and black leads may be interchanged without causing the meter to read backwards.

All AC ranges are read on the two black center scales except 3V and 1.5V. For greater accuracy two separate red scales have been provided to read 3V-AC and 1.5V-AC.

With Slide Switch In V-Ω-A Position:

The full scale reading of the instrument is identical to that indicated by the large range switch knob. Thus with the range switch knob at 1200, note that 1200 volts is read on the 12 volt scale by adding two zeros (multiplying your reading by 100). There are scales provided for 1.5, 3, 12, 60, 150 and 300. Other ranges are read similarly by adding or omitting zeros as required.

The meter sensitivity is 5000 ohms per volt with slide switch in V-Ω-A position.

With Slide Switch In $\frac{V \cdot A}{2}$ Position:

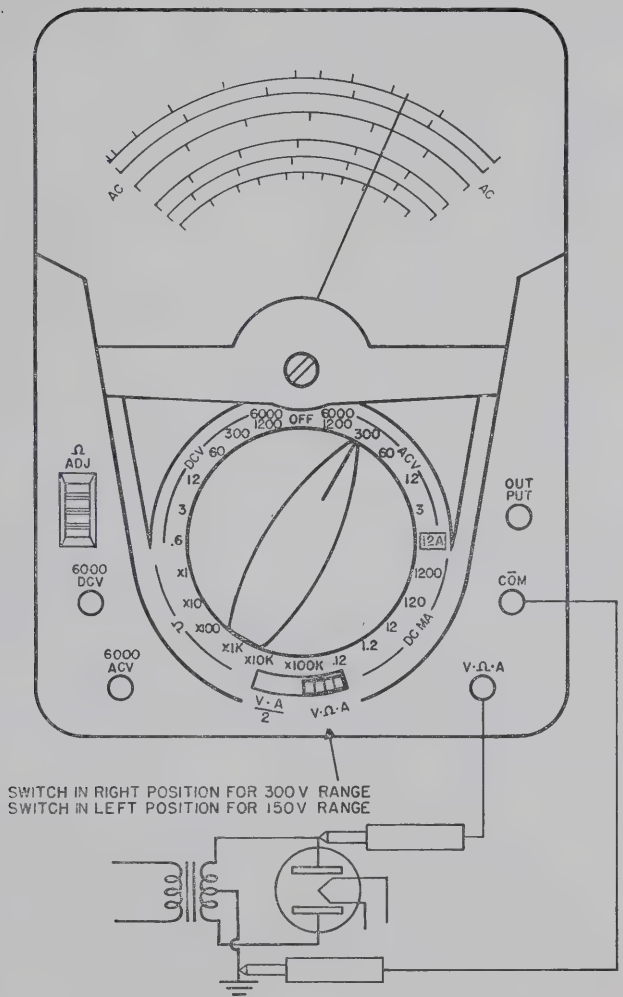
The instrument will read exactly half of the value indicated by the large range switch knob. Thus with the range knob set at 300, the meter actually will read 150. The scale immediately above the mirror is used for 0-150 volts. With the range switch knob set on 60, the meter will read 30 volt full scale. Read this on the 300 volt scale by dropping one zero (i. e. dividing by 10). Other ranges are handled in a similar fashion.

The meter sensitivity is 10,000 ohms per volt with the switch in this position.

CAUTION For maximum safety do not handle tester or leads when connected to high voltages.

For handy operation chart see pages 16 and 17

Measuring AC Volts



Measuring DC Resistance

Rotate the selector switch to the appropriate range for ohms determined from the following chart:

To read ohms the slide switch must be in the right or V-Ω-A position.

0-1,000	ohms	X1
0-10,000	ohms	X10
0-100,000	ohms	X100
0-1,000,000	ohms	X1K
0-10,000,000	ohms	X10K
0-100,000,000	ohms	X100K

Plug the black test leads into the "COM" jack and the red lead into the V-Ω-A jack as shown on the opposite page.

Short the test probes together and adjust the Ω-ADJ control until the meter pointer reads 0 on top red ohms scale.

Connect the test probes across the resistor as shown. If the resistor is wired in a circuit, disconnect one end of the resistor before taking the reading.

Each time an ohm range is changed, it is well to check the zero setting as outlined in paragraph above.

The basic scale 0-1K (0-1000 ohms) is used for reading all ohm ranges. Simply multiply the scale numbers by 10, 100, 1K, 10K, 100K as indicated by the selector switch setting.

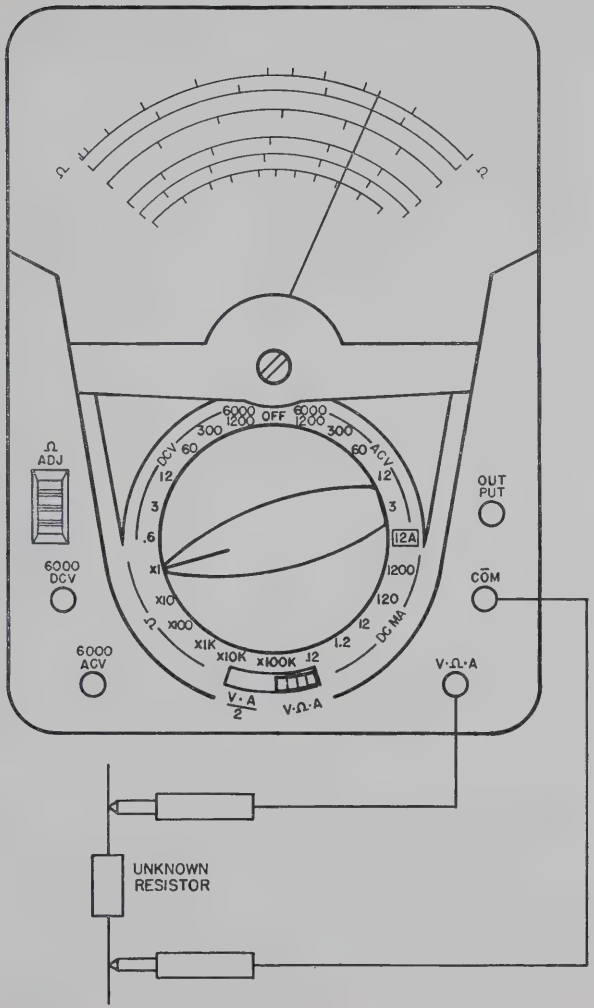
It should be kept in mind that in the measurement of resistance a current is passed through the unknown resistor. Generally this current is so small as to be negligible. However, on the XI range fairly high current is employed.

CAUTION: On the XI ohm position reading at center scale (4.4 ohms) the current drain from the 1.5 volt battery is 170 MA. It is desirable to make a practice of using one of the higher ohm ranges for general continuity or circuit testing to extend the life of the batteries.

Since the scale of an ohmmeter is non-linear, the accuracy of the reading cannot be expressed as a per cent of full scale. Ohmmeter accuracy is generally referred to a linear scale such as the DC volt scale. Thus ±3% ohmmeter accuracy means an allowable ± 1.8 division on the 60 division DC scale. For example 2 ohms could read from about 1.75 to 2.3 ohms and be within tolerance.

For handy operation chart see pages 16 and 17

Measuring DC Resistance



Measuring DC Current

Rotate the selector switch to the appropriate range for DC current. Always start with the highest range if in doubt as to the approximate current.

In choosing ranges, endeavor to have the readings fall in the upper, or right hand, half of the scale for greatest accuracy.

Plug the black test probe into the "COM" jack and the red probe into the V-Ω-A as shown on opposite page.

Connect the test probes in series with the circuit to be measured. Do not test directly across any potential circuits as this may burn out the shunt. The red lead is positive. Where polarity is difficult to determine, the meter may read backwards. No damage will be done if this occurs. Simply reverse the leads.

All DC current ranges are read on the scale just below the mirror.

With Slide Switch in V-Ω-A Position

The full scale reading of the instrument is identical to that indicated by the large range switch knob. Thus with the range switch knob at 120 note that the 0-120 Milliamperes is read on the 12 Milliampere scale simply by adding one zero (or multiply by 10). Other ranges are read similarly by adding or omitting zeros as required.

With Slide Switch In $\frac{V \cdot A}{2}$ Position:

The instrument will read exactly half of the value indicated by the large range switch knob. Thus with the range knob set at 120 the meter actually will read 60 Milliamperes.

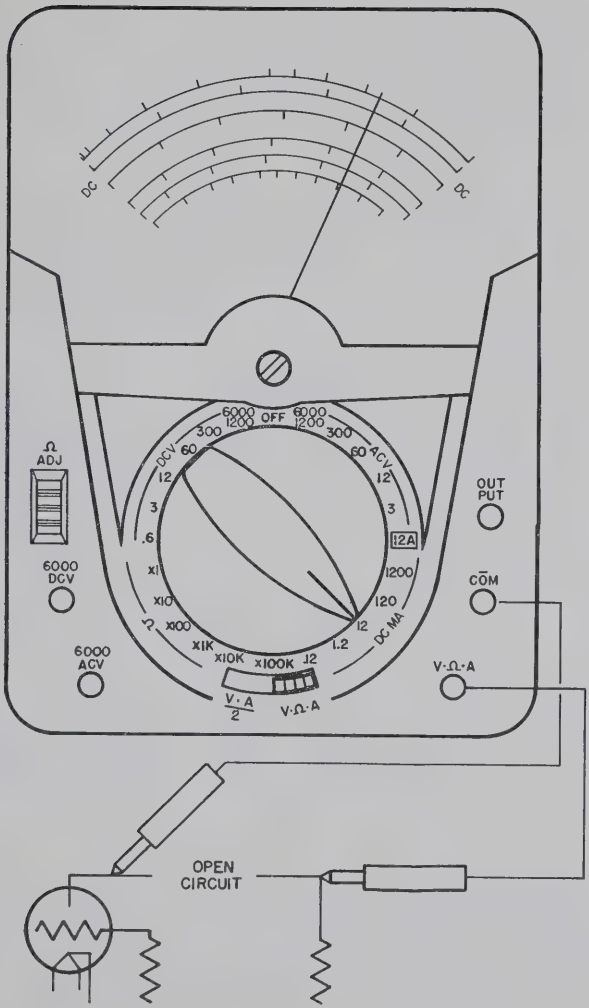
Other ranges are handled in a similar fashion.

CAUTION: Turn off the power before connecting the meter to the circuit. Do not handle the tester or leads in high voltage circuits.

In using the 60 microampere range, the meter reading may differ from actual calculations. This is sometimes caused in low current circuits by a slight leakage of voltage due to moisture. Other times a slight potential is generated by soldering or joining dissimilar metals. Even the proximity of fumes or liquid acids and alkalies may react with the metal parts of the circuit and generate slight current. The fingers should not be permitted to touch the metal parts of the probes or circuit, as body resistance can also upset some circuits.

For handy operation chart see pages 16 and 17

Measuring DC Current



Measuring Output Volts (DB)

Output is generally measured in units called the decibel, a terminology used to indicate power levels in amplifiers or telephone work. The DB scale on your meter is based on the voltage developed across a 600 ohm line when .001 watts is dissipated in the line. Do not confuse the DB with the VU (Volume Unit).

Rotate the selector switch to the appropriate AC volt range, see page 8. Refer to the small chart on the meter dial for the range to use. Always start with the highest range if in doubt as to the approximate number of decibels.

Normally it is recommended output be measured by plugging the black test lead into the "COM" jack and the red lead into the "OUTPUT" jack.

Often a DC voltage is present in the circuit where output is to be measured. The extra jack marked "OUTPUT" with a .1 mfd condenser in series is provided to block the DC.

The condenser impedance is generally disregarded in most measurements. Where no DC is present, this output voltage can be read accurately by using the 630-NA as a regular AC voltmeter (i. e. by plugging the red lead into the "V-Ω-A" jack instead of "OUTPUT").

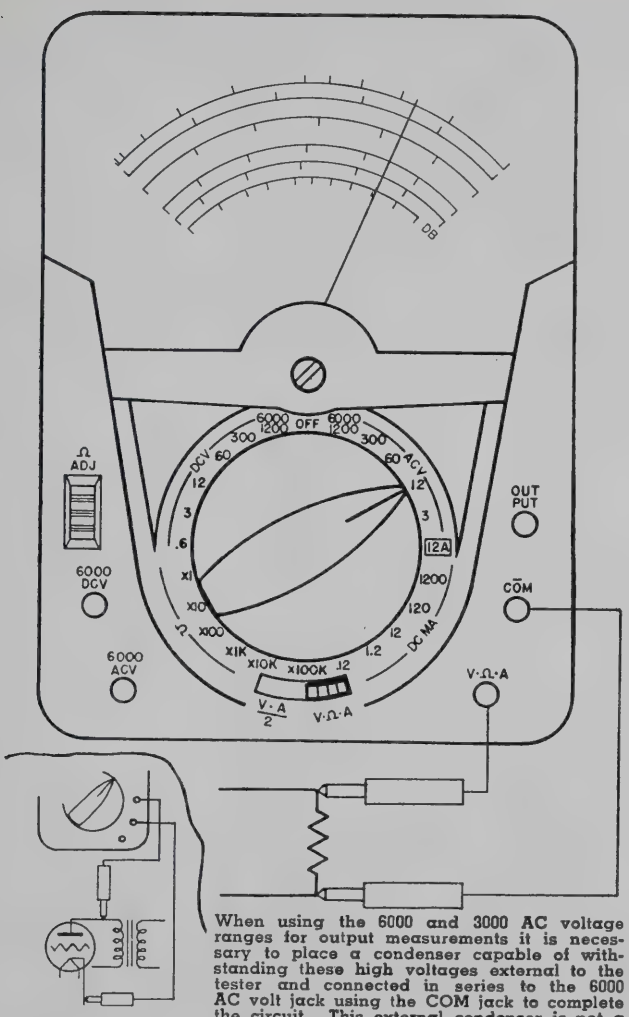
Connect the test prods across the plate circuit or 600 ohm line.

Read all DB ranges on the bottom black scale, with the small chart on the meter dial. For example, when the selector switch is set on the 3 AC volt range and the slide switch in V-Ω-A position, the DB scale is direct reading. When on the 12 AC volt range, add 12 to each number on the DB scale, thus with the meter reading -2, the actual DB reading is +10 DB.

If line impedance is not 600 ohms (as in speaker voice coils) the readings will be only relative — not actual DB.

When measuring AC volts of high frequency such as 15,000 to 20,000 cycles it is best to clip the leads to the voltage point under test. Hand capacity can affect the voltage reading at high frequency.

For handy operation chart see pages 16 and 17



When using the 6000 and 3000 AC voltage ranges for output measurements it is necessary to place a condenser capable of withstanding these high voltages external to the tester and connected in series to the 6000 AC volt jack using the COM jack to complete the circuit. This external condenser is not a furnished part of the equipment.

To MEASURE	SET SELECTOR SWITCH TO	SET SLIDE SWITCH
DC VOLTS		
.12 (120 MV.)	.12 MA	V-A÷2 Position
.24 (240 MV.)	.12 MA	V-Ω-A Position
.3	.6 DCV	V-A÷2 Position
.6	.6 DCV	V-Ω-A Position
1.5	3 DCV	V-A÷2 Position
3	3 DCV	V-Ω-A Position
6	12 DCV	V-A÷2 Position
12	12 DCV	V-Ω-A Position
30	60 DCV	V-A÷2 Position
60	60 DCV	V-Ω-A Position
150	300 DCV	V-A÷2 Position
300	300 DCV	V-Ω-A Position
600	1200 DCV	V-A÷2 Position
1200	1200 DCV	V-Ω-A Position
3000	6000 DCV	V-A÷2 Position
6000	6000 DCV	V-Ω-A Position
AC VOLTS		
1.5	3 ACV	V-A÷2 Position
3	3 ACV	V-Ω-A Position
6	12 ACV	V-A÷2 Position
12	12 ACV	V-Ω-A Position
30	60 ACV	V-A÷2 Position
60	60 ACV	V-Ω-A Position
150	300 ACV	V-A÷2 Position
300	300 ACV	V-Ω-A Position
600	1200 ACV	V-A÷2 Position
1200	1200 ACV	V-Ω-A Position
3000	6000 ACV	V-A÷2 Position
6000	6000 ACV	V-Ω-A Position
DC CURRENT		
.06 MA	.12 MA	V-A÷2 Position
.12 MA	.12 MA	V-Ω-A Position
.6 MA	1.2 MA	V-A÷2 Position
1.2 MA	1.2 MA	V-Ω-A Position
6 MA	12 MA	V-A÷2 Position
12 MA	12 MA	V-Ω-A Position
60 MA	120 MA	V-A÷2 Position
120 MA	120 MA	V-Ω-A Position
600 MA	1200 MA	V-A÷2 Position
1200 MA	1200 MA	V-Ω-A Position
6 Amp.	12 Amp	V-A÷2 Position
12 Amp.	12 Amp	V-Ω-A Position
OHMS		
0 to 1,000	×1 OHMS	V-Ω-A Position
0 to 10,000	×10 OHMS	V-Ω-A Position
0 to 100,000	×100 OHMS	V-Ω-A Position
0 to 1,000,000	×1000 OHMS	V-Ω-A Position
0 to 10 Meg.	×10K OHMS	V-Ω-A Position
0 to 100 Meg.	×100K OHMS	V-Ω-A Position
DECIBELS		
−20 to +63 (To+ 77 see page 15)	Select AC range according to table on Dial.	V-Ω-A or V-A÷2

CONNECT TEST LEADS IN JACK MARKED	READ ON SCALE	MULTIPLY OR DIVIDE SCALES
V-Ω-A & COM	12	÷100
V-Ω-A & COM	12	÷50
V-Ω-A & COM	300	÷1000
V-Ω-A & COM	60	÷100
V-Ω-A & COM	150	÷100
V-Ω-A & COM	300	÷100
V-Ω-A & COM	60	÷10
V-Ω-A & COM	12	Read Direct
V-Ω-A & COM	300	÷10
V-Ω-A & COM	60	Read Direct
V-Ω-A & COM	150	Read Direct
V-Ω-A & COM	300	Read Direct
V-Ω-A & COM	60	×10
V-Ω-A & COM	12	×100
6000 DC & COM	300	×10
6000 DC & COM	60	×100
V-Ω-A & COM	1.5	Read Direct
V-Ω-A & COM	3	Read Direct
V-Ω-A & COM	60	÷10
V-Ω-A & COM	12	Read Direct
V-Ω-A & COM	300	÷10
V-Ω-A & COM	60	Read Direct
V-Ω-A & COM	150	Read Direct
V-Ω-A & COM	300	Read Direct
V-Ω-A & COM	60	×10
V-Ω-A & COM	12	×100
6000 AC & COM	30	×100
6000 AC & COM	60	×100
V-Ω-A & COM	60	÷1000
V-Ω-A & COM	12	÷100
V-Ω-A & COM	60	÷100
V-Ω-A & COM	12	÷10
V-Ω-A & COM	60	÷10
V-Ω-A & COM	12	Read Direct
V-Ω-A & COM	60	Read Direct
V-Ω-A & COM	12	×10
V-Ω-A & COM	60	×10
V-Ω-A & COM	12	×100
V-Ω-A & COM	60	÷10
V-Ω-A & COM	12	Read Direct
V-Ω-A & COM	Red Ohm 0-1000	Read Direct
V-Ω-A & COM	Red Ohm 0-1000	×10
V-Ω-A & COM	Red Ohm 0-1000	×100
V-Ω-A & COM	Red Ohm 0-1000	×1000
V-Ω-A & COM	Red Ohm 0-1000	×10,000
V-Ω-A & COM	Red Ohm 0-1000	×100,000
V-Ω-A & COM or OUTPUT & COM	DB	Use Table On Dial

OPERATION

Measuring Capacity

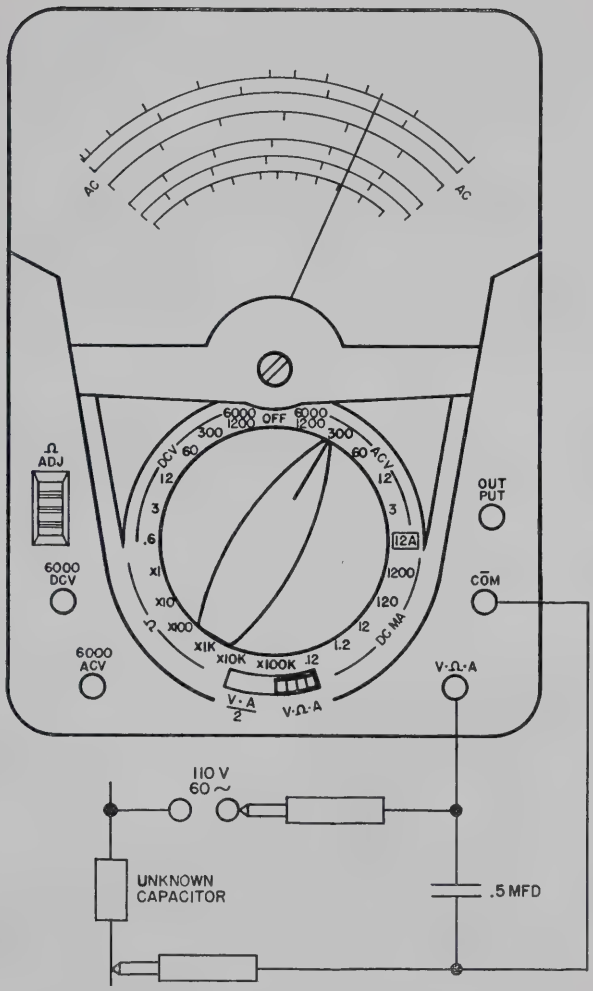
Your 630-NA can be used to measure capacity by the arrangement shown on opposite page. For such measurements the tester is set up as an AC voltmeter.

Use the following chart to determine the AC voltage range to use. ALWAYS start with the selector switch on the 300 volt range for if the condenser is shorted, serious damage may result to the meter when on a low range.

To Measure MFD	Set Selector Switch to	Deflection in AC Volts
.002	3 ACV	.45
.004		.83
.006		1.25
.008		1.65
.010		2.10
.020	12 ACV	4.3
.04		7.7
.05		9.7
.08	60 ACV	14.5
.10		17.5
.2		30.0
.4		45.0
.6		57.0
.8	300 ACV	65.0
1.0		75.0
2.0		85.0
5.0		95.0
10.0		100.0

CAUTION: DO NOT ATTEMPT TO USE THIS TEST ON ELECTROLYTIC CONDENSERS.

Measuring Capacity

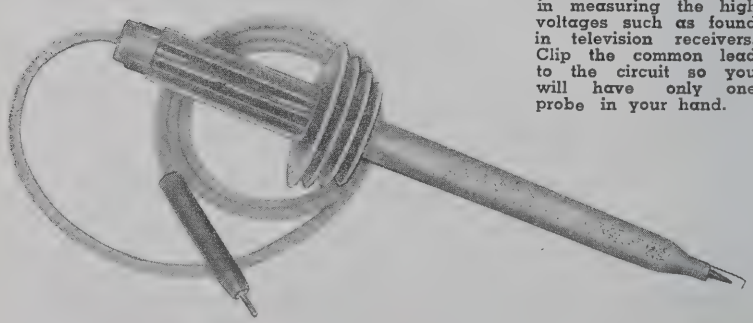


Measuring Kilovolts

For measuring the high voltage employed in television receivers and in other applications, an external probe is available. Probes are made in three ranges, 0-12,000, 0-30,000 and 0-60,000 volts. Common usage is on DC. Probes for AC are also available in the lower ranges.

To use the D. C. Kilovolt probe set the range selector switch on the 3 volt D. C. position, and set the slide switch on the V-Ω-A position. When the A. C. probe is used set the range selector switch on the 3 volt A. C. position, set the slide switch on the V-Ω-A position. Plug the Kilovolt probe lead into the V-Ω-A jack at the lower right corner of the front panel. Use the black standard lead for negative or common lead with it connected into the COM jack located on the lower right side of front panel.

Kilovolt Probe	Set Selector Switch	Set Slide Switch	Read on Range	Multiply By
0-30KV DC	3 V DC	V-Ω-A	0-300V	100
0-30KV AC	3 V AC	V-Ω-A	0-300V	100
0-60KV AC	3 V AC	V-Ω-A	0-60V	1000



USE EXTREME CAUTION in measuring the high voltages such as found in television receivers. Clip the common lead to the circuit so you will have only one probe in your hand.

Measuring High DC Current

External plug-in shunts are available to extend the DC current ranges of your 630-NA from the self-contained 0-12 amps range to 0-30 amps. External portable shunts up to 120 amperes also are available. (See paragraph on accessories.)

Set the 630-NA selector switch to the 12 Ma. position and plug the desired external shunt into the COM and V-Ω-A jacks. Connect the line to be measured to the binding posts on top of the shunts. The external portable shunts are too large to plug into the panel and must be connected to the panel jacks by the leads furnished with the shunts.

Accessories

The following accessories for your 630-NA are available from your distributor:

Item	Part No.
Hi-Voltage probe 0-30 Kv DC & 0-60 Kv AC	T-79-152
Hi-Voltage probe 0-30 Kv AC	T-79-71
Carrying cases	639, 639-N, 639-P
Plug-in external shunt 0-30 DC Amp.	T-91-429
Portable external shunt 0-60 DC Amp.	T-91-430
Portable external shunt 0-120 DC Amp.	T-91-431
Tester Stand (Holds tester at approximately 45° angle while working on bench.)	T-255A-33
Clamp-On Ammeter Adapter Model 10	60-A-211
Lead Assembly No. 611 (used in connection with Model 10)	79-A-160
Line Separator, Model 101 (used in connection with Model 10)	60-A-218

ADDITIONAL APPLICATIONS

In The Home

When your refrigerator motor fails to "kick out" the starting winding, use the 630-NA to measure the AC line voltage. If the voltage is below 100 volts, notify your power company.

If your electric stove does not seem to heat quickly enough, measure the voltage input to the stove with all burners turned on and again with all burners turned off. If the difference between these two voltages is 10 or 15 volts, the power cable to the stove has defective connections or is not of large enough current carrying capacity.

Blown fuses sometimes do not visibly indicate they are burned out. With your 630-NA, measure the voltage ahead of and behind the fuse. Voltage ahead of the fuse but no voltage following indicates a blown, defective, or loose fuse. Sometimes it is easier to remove the fuse and measure its resistance. This should be substantially zero.

Your 630-NA is handy for locating trouble in desk and floor lamps. Pull the plug from the wall socket and check for a faulty cord, plug, switch, socket, or bulb by measuring resistance on the Ω-X1 range. 100 watt 120 volt bulbs should read 10 to 20 ohms. 50 watt 120 volt bulbs should read 20 to 40 ohms.

For the Radio Man

In addition to all common voltage, current, and resistance measurements used in servicing radios, the high sensitivity of your 630-NA is well adapted to measuring AFC, AVC, bias and FM discriminator voltages.

Measurements of high voltage up to 27,000 volts used in some television receivers for the picture tube can be effected with the special high voltage probe shown on page 20.

Considerable trouble is had with leakage in automobile radio antennas (due to moisture). Your 630-NA with the high ohm range 0-100 meg. is ideal to check this leakage. Disconnect the antenna from the receiver before making this check.

In The Industrial Plant

Your 630-NA will be a big help in checking voltage drop caused by adding that extra machine on the already overloaded line. Correcting this will often save time later when a rush comes and the line "just happens" to burn up.

First measure the voltage at the machine with the machine turned off; then again with the machine in operation. If the voltage is proper with the machine off but low with the machine in operation, the circuit wiring or transformers have too small a capacity. If the voltage is low even with the machine off, the circuit is probably already overloaded and the machine should be wired into another circuit.

Equipment using automatic electric controls can be checked with the 630-NA. Faulty relay or control action is often caused by low voltage applied to the relay or control. This low voltage in turn, may be caused by burned or dirty contacts on the control device. Use the ΩX1 range to check for high or unstable contact resistance.

When a phone on your dial telephone system fails, measure the line current and the voltage to the particular relay in question. If the voltage is proper, measure the contact resistance of the relay contacts using the ΩX1 scale on your 630-NA. If this resistance is over a fraction of an ohm or if the resistance seems to waver, clean and adjust the relay contacts.

In The Garage

Fuses in the automobiles have a tendency to look perfectly good and yet not function due to corrosion under the metal end cap. Measure the voltage ahead and behind the fuse to determine a defective unit. Or remove the fuse and measure its resistance. Anything over a fraction of an ohm is too high.

Checking automobile wiring, light switches, heaters, radios, etc., can be speeded up by simple use of your 630-NA.

In The Laboratory

Your 630-NA is built with all precision, non-aging resistors. The specially designed switch and special banana type plugs insure lasting accuracy. The meter with Taut-Band Suspension and a well designed stable magnet further makes the 630-NA a must for the laboratory.

Special Applications

The unusually high range ohmmeter in your 630-NA permits some indication of condenser leakage resistance. Measure as a resistor, see page 10, using the highest range. A good paper or mica condenser under 1 mfd. will indicate at the 100 Meg. mark or above. If a steady reading (taken after the initial surge required to charge the condenser) of less than 100 megohms is obtained, the condenser probably has defective insulation. Good paper condensers over 1 mfd. may read somewhat less than 100 megohms. Electrolytic condensers, should read above .1 megohm. In checking electrolytic condensers, the black test lead (COM jack) should be connected to the positive terminal of the condenser.

Checks of insulation resistance for motors, generators, telephone cables, power cables, etc., can be made on the high ohmmeter range of your 630-NA. The actual value of resistance may vary from a few megohms to over 100 meg., depending on weather conditions and quality of insulation. The best method, therefore, is to make periodic checks on important cables or equipment and observe the trend in readings. As the readings tend to be lower and lower, it is time to start drying out the equipment or determine the cause of deterioration. Dirt, mice, or foreign matter can sometimes cause excessive leakage.

Audio Specialist

The model 630-NA is the ideal instrument for audio engineering and maintenance. The frequency compensation in this instrument will allow you to read volume level from 35 cps to 20KC.

MAINTENANCE

Battery Replacement

Two batteries are used for the ohmmeter circuits, a 1.5 volt Burgess No. 2 or equivalent and a 30 volt Eveready No. 413 or equivalent.

When the meter pointer can no longer be adjusted to zero (see page 10) ohms on the ΩX1, ΩX10, or ΩX1000 ranges, replace the 1.5 volt battery.

When the meter pointer can no longer be adjusted to zero ohms on the ΩX10,000 and ΩX100,000 range, replace the 30 volt battery.

To replace batteries, remove the four screws in the bottom of the case and lift panel from the case. Remove the old battery and replace with a new one.

Fuse Replacement

A one ampere fuse is incorporated in the ohm circuits for protecting the ohm circuit when it is accidentally placed across high voltage. A spare fuse is attached to unit inside the tester.

Note: This fuse is in series with ohmmeter circuit and is physically mounted on the back of the meter housing.
You are cautioned not to substitute the indicated 3AG Littlefuse for it can disturb the balance of the circuit and read in error.

Cleaning Plastic Window

The plastic window has been treated at the factory to dissipate static charges. If cleaning is required, use cotton dipped in a solution of common household detergent and water. After cleaning, allow the solution to dry without rubbing.

Care

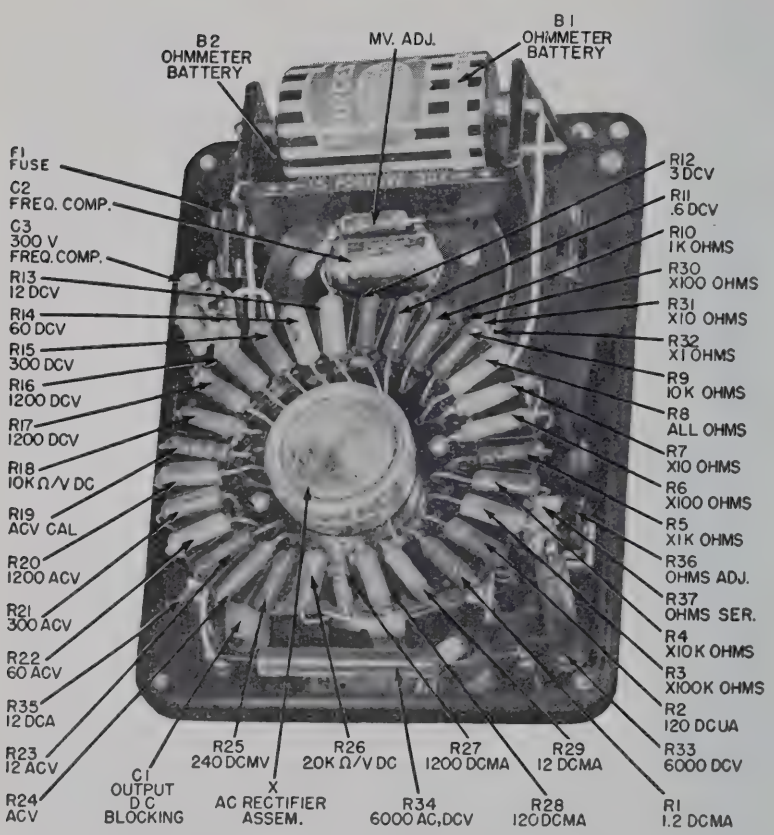
Avoid placing your tester on a bench where machine tools are used or severe vibration is encountered.

If the unit has not been in use for a long period of time, rotating the switch in both directions several times will wipe the contacts clean for good contact.

In use, don't take chances on overloading the resistors or shunts. If in doubt as to the approximate reading always start with the highest range.

Turn the selector switch to OFF when the unit is to be carried. With the selector switch in the OFF position the meter is damped and this will prevent wild swinging of the pointer.

INTERIOR VIEW
PARTS LOCATION

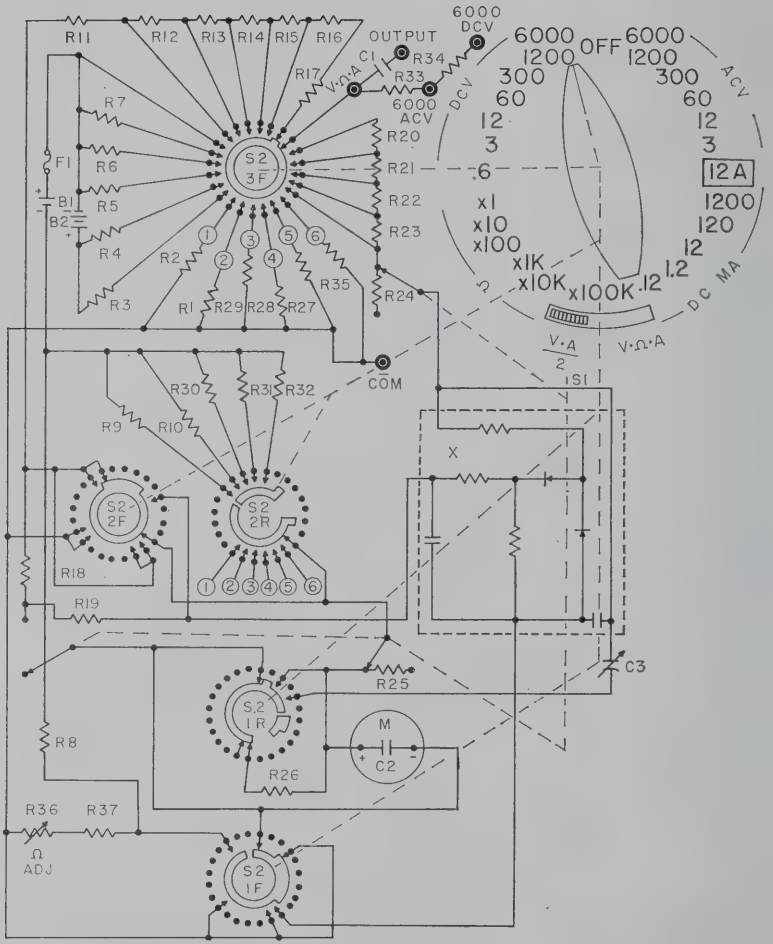


REPAIR AND SERVICE

The Triplett Company suggests when you send your tester in for repair or service you indicate the nature of service required. By supplying this information the Triplett Co. or our service stations can serve you better and you will receive your tester back in less time.

REF. NO.	REQ.	NAME	DESCRIPTION	TRIPLETT NO.
R1	1	Resistor	Film type, 218.2 ohm, ±½%	T-15-2567
R2, R26	2	Resistor	Film type, 12K, ±½%, ½W, 2½" leads	T-15-2522
R3	1	Resistor	Film type, 423K, ±½%, ½W	T-15-4110
R4	1	Resistor	Film type, 42.3K, ±½%, ½W	T-15-4124
R5	1	Resistor	Film type, 732 ohm, ±1%	T-15-4119
R6	1	Resistor	Film type, 71 ohm, ±1%	T-15-4125
R7	1	Resistor	Wire, 6.5 ohm, ±½%	T-15-4114
R8	1	Resistor	Film type, 14K, ±½%, ½W	T-15-4121
R9	1	Resistor	Film type, 1880 ohm, ±½%, ½W	T-15-4123
R10	1	Resistor	Film type, 4690 ohm, ±½%, ½W	T-15-4112
R11	1	Resistor	Film type, 3600 ohm, ±½%, ½W	T-15-2540
R12	1	Resistor	Film type, 24K, ±½%, ½W	T-15-2541
R13	1	Resistor	Film type 90K, ±½%, ½W	T-15-2543
R14	1	Resistor	Film type, 480K ±½%, ½W	T-15-2544
R15	1	Resistor	Film type, 2.4M ±½%, ½W	T-15-2513
R16, R17, R20	3	Resistor	Film type, 4.5M, ±½%, ½W	T-15-1554
R18	1	Resistor	Film type, 4800 ohm, ±½%, ½W, 2½" lds.	T-15-2568
R19	1	Resistor	Film type, 5230 ohm, ±½%, ½W	T-15-4104
R21	1	Resistor	Film type, 1.2M, ±½%, ½W	T-15-1553
R22	1	Resistor	Film type, 240K, ±½%, ½W	T-15-1552
R23	1	Resistor	Film type, 45K, ±½%, ½W	T-15-1551
R24	1	Resistor	Film type, 449 ohm, ±1%, ½W	T-15-1178
R25	1	Resistor	Film type, 2400 ohm ±½%, ½W	T-15-2539
R27	1	Resistor	Wire, .1972 ohm, ±¼%	T-15-2371
R28	1	Resistor	Wire, 2 ohm, ±¼%	T-15-2372
R29	1	Resistor	Wire, 20.1 ohm, ±¼%	T-15-2373
R30	1	Resistor	Film, 377 ohm, ±½%, ½W	T-15-4122
R31	1	Resistor	Film type, 37.2 ohm, ±½%, ½W	T-15-4115
R32	1	Resistor	Wire, 3.7 ohm, ±¼%	T-15-3224
R33	1	Resistor	Film type, 24M, ±1%, 2W, No. 18 lead.	T-15-2464
R34	1	Resistor	Film type, 24M, ±1%, 2W	T-15-1226
R35	1	Shunt	12 Amp	T-90A-378
R36	1	Resistor	Variable, 20K	T-16-31
R37	1	Resistor	Composition, 3600 ohm, ±5%, ½W	T-15-1456
C1	1	Capacitor	0.1 mfd., 400V, Midget Sprague No. 68P21	T-43-69
C2	1	Capacitor	1 mfd., 200V, Aerovox P-82	T-43-176
C3	1	Capacitor	Arco No. 466, 80-480 mmfd.	T-43-199
B1	1	Battery	1.5V Burgess #2, Flash lite "D" cell or NEDA No. 813	available locally
B2	1	Battery	30V Burgess, U20E, Eveready No. 413 or NEDA No. 210	
M	1	Meter	40 Micro-amps, 120 Millivolts	52-3566
X	1	Rectifier	Assembly	T-2250A-24
S1, S2	1	Switch	4 deck, 24 position without res.	22A-456
	1	Knob	Molded, Selector switch (with clip)	34B-6Z
	1	Knob	Molded, slide switch	T-34B-47
	1	Clip	Tinnerman, knob retaining	2451-51
	1 pr.	Leads	Banana type	T-79-127
	1	Case	Bakelite, with handle	T-10-784
	1	Front	Clear plastic with zero adj.	10-2148
	1	Ball	Bearing ⅛D, Slide Switch	10779
	1	Spring	Helical, Ball retaining	T-42-148
	1	Plate	Slide type, Knob retaining	10756A
	5	Contact	Jack	8944
	1	Clip	Shunt retaining	T-2451-6
S1, S2	1	Switch	4 deck, 24 position, with res.	22-458
F1	2	Fuse	1 amp. Littelfuse 3AG, 312001	3207-15

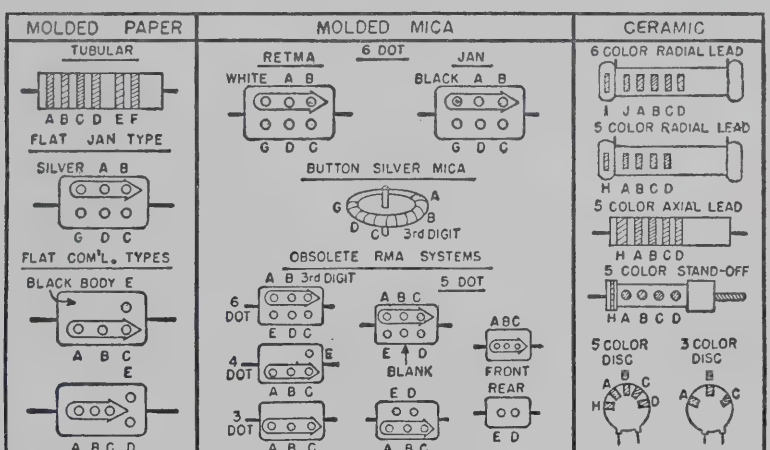
CIRCUIT DIAGRAM



EIA MICA CONDENSER COLOR CODE

Color	MOLDED PAPER Multiplier	Tolerance	MOLDED MICA Multiplier	Tolerance	CERAMIC Multipler	Tolerance
Black	1	20%	1	20%	1	20% or 2.0$\mu\mu$fd.*
Brown	10		10		10	1%
Red	100		100	20% EIA	100	2%
Orange	1000		1000	3% EIA	1000	2.5% EIA
Yellow	10,000	5%	10,000		10,000	
Green				5% EIA		5% or 0.5$\mu\mu$fd.*
Blue						
Violet						
Gray					0.01	0.25$\mu\mu$fd.*
White		10%			0.1	10% or 1.0$\mu\mu$fd.*
Gold	0.1	5%	0.1			
Silver		10%	0.01	5% (JAN) 10%		
None		20%				

* Capacitance less than 10$\mu\mu$fd.



(Courtesy Popular Electronics)

Capacitance is given in $\mu\mu$fd.

Colors—Same value as on resistors except as indicated in tables.

COLORS	INDICATES
A	First digit
B	Second digit
C	Multiplier
D	Tolerance
E & F	Voltage Rating in hundreds of volts

[(E) Ratings less than 1000 volts. (E) & (F) First two digits of ratings 1000 volts or more. Values of colors for (E) & (F) are same as in resistance values. (G) is class or characteristics of capacitor. (H), (I) & (J) give temperature coefficient. (G), (H), (I) & (J) are not listed in the tables.]

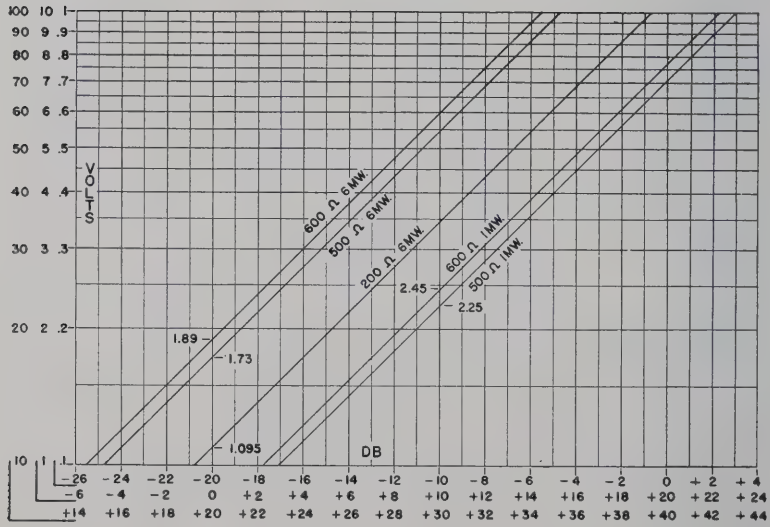
A. F. or Decibels

Audio output generally is measured in units called Decibels, a terminology used to indicate audio power levels in an amplifier to telephone work. Zero DB is set at .775 Volts, this being the voltage developed across a 600 Ohm line when .001 Watt is dissipated in the line.

DO NOT confuse the DB with the VU (Volume Unit.) The VU is based on .001 Watt dissipated in a 600 ohm line and is measured with a meter having special ballistic characteristics.

Decibels are measured by means of the Black DB Scale. Leads connected as shown on page 15.

For reading DB other than 600 ohm line use chart below.



DB CHART

0 DB at 1 Mw Decibels with 600 ohm line	Line Power Mw	RMS Volts with line Imped. of 600 ohms
—20	.01	.0775
—10	.1	.245
—5	.316	.436
0	1.00	.775
+10	10.0	2.45
+15	31.6	4.36
+20	100	7.75
+30	1,000	24.5
+40	10,000	77.5
+50	100,000	245.
+60	1,000,000	775.
+70	10,000,000	2450

Note:

The range of audibility can be considered to lie from 70 db below the normal speech level to 70 db above the same level, or a total range of 140 db.

EIA SPEAKER COLOR CODE

Voice — Coil:

Green — finish
Black — start

Field Coils:

Black and red — start
Yellow and red — finish
Slate and Red — tap (if any)

EIA WIRING COLOR CODE

B+ - - - - - - - Red
Ground - - - - - - Black
Plate - - - - - - - Blue
Grid - - - - - - Green
Cathode - - - - Yellow
High Heater - - - Brown
Low Heater - - - Black
Screen Grid - - - Orange
AVC - - - - - - White

EIA TRANSFORMER COLOR CODE

I. F. Transformers:

Blue — plate lead
Red — "B" + lead
Green — grid (or diode) lead
Black — grid (or diode) return

NOTE: If the secondary of the i. f. t. is center-tapped, the second diode plate lead is green-and-black striped, and black is used for the center-tap lead.

Power Transformers:

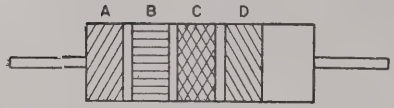
1. Primary Leads.....Black
   If tapped: Common.....Black
   Tap.....Black and Yellow Striped
   Finish.....Black and Red Striped
2. High-Voltage Plate Winding.....Red
   Center-Tap.....Red and Yellow Striped
3. Rectifier Fil. Winding.....Yellow
   Center-Tap....Yellow and Blue Striped
4. Fil. Winding No. 1.....Green
   Center-Tap.....Green and Yellow Striped
5. Fil. Winding No. 2.....Brown
   Center-Tap.....Brown and Yellow Striped
6. Fil. Winding No. 3.....Slate
   Center tap.....Slate and Yellow Striped

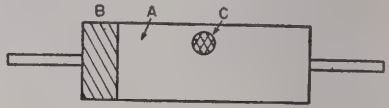
A. F. Transformers:

Blue — plate (finish) lead of primary
Red — "B"+ lead (this applies whether the primary is plain or center-tapped).
Brown — plate (start) lead on center tapped primaries (Blue may be used for this lead if polarity is not important.)
Green — grid (finish) lead to secondary
Black — grid return (this applies whether the secondary is plain or center-tapped.)
Yellow — grid (start) lead on center tapped secondaries. (Green may be used for this lead if polarity is not important.)

Note: These markings apply also to line-to-grid, and tube-to-line transformers.

EIA RESISTOR COLOR CODE





Color	Indicates
A	First number
B	Second number
C	Number of zeros
D	Tolerance

Color	Number	Color	Number
Black	0	Violet	7
Brown	1	Gray	8
Red	2	White	9
Orange	3	Gold	5% tolerance
Yellow	4	Silver	10% tolerance
Green	5	None	20% tolerance
Blue	6		

The resulting value is in ohms.

Example:
A 250,000 ohm 20% resistor.
A red B Green C Yellow D no color

INSTRUCTION MANUAL

CAPACITANCE METER

FUNCTIONAL CHARACTERISTICS

DISPLAY	0.5" (13mm) liquid crystal display 3½ digits Maximum indication 1999
SAMPLING TIME	0.5 second
OVERLOAD INDICATION	Display "1"
ZERO ADJUSTMENT	Adjustment for zero on front panel knob.
POWER	DC 9V Battery
BATTERY LIFE	Approx. 200 Hours (Alkaline Battery) 100 Hours (Carbon Zinc Battery)
POWER CONSUMPTION	3-4mA
OPERATING ENVIRONMENT	0℃ – 40℃ (32℉ – 104℉) less than 85% RH
DIMENSIONS	180L x 82W x 38H mm (7.1"L x 3.2"W x 1.5"H)
WEIGHT	280g. (9.9 oz.) including battery.
ACCESSORIES	Test leads 1 pair Spare Fuse (0.2A) 1 pc. 9V Battery 1 pc. Instruction manual 1 pc.

ELECTRICAL SPECIFICATION

ACCURACY (25℃ ±5℃): 0.5% of full scale ±1 LSD. (least significant digit) on 200PF to 200uF range.
1% of full scale ±1 LSD on 2000uF range.

ZERO ADJUSTMENT PROTECTION: A fuse (0.2A) protects against damage from charged capacitors that are more than DC50 Volts.

NORMAL RANGE	MAX. IN-RANGE DISPLAY	RESOLUTION	TEST FREQUENCY
200 PF	199.9 pF	0.1 pF	800 Hz
2 nF	1.999 nF	1 pF	800 Hz
20 nF	19.99 nF	10 pF	800 Hz
200 nF	199.9 nF	100 pF	800 Hz
2 uF	1.999 uF	1000 pF	800 Hz
20 uF	19.99 uF	0.01 uF	80 Hz
200 uF	199.9 uF	0.1 uF	8 Hz
2000 uF	1999 uF	1 uF	8 Hz

MAINTENANCE

REPLACING THE BATTERY

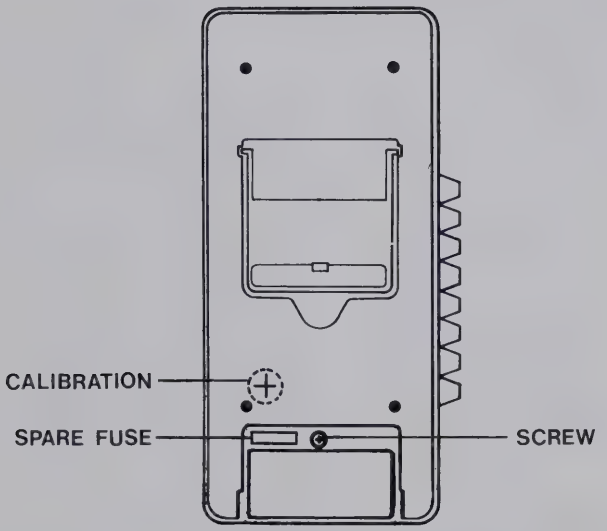
Replace a new battery as "LOBAT" shown on the left corner of LC Display, or the "LOBAT" sign is flashing while the large value capacitor is under test.

TO REPLACE THE BATTERY

Remove the battery lid by pushing the knurled area then replace a new battery.

REPLACING THE FUSE

This meter is provided with a 0.2A fuse to protect the charged capacitor (more than 50 Volt) connected to the test input terminal. To replace the fuse, remove the rear cabinet by loosening the screw inside the battery box.



FUNCTIONAL CHARACTERISTICS

DISPLAY	0.5" (13mm) liquid crystal display 3½ digits Maximum indication 1999
SAMPLING TIME	0.5 second
OVERLOAD INDICATION	Display "1"
ZERO ADJUSTMENT	Adjustment for zero on front panel knob.
POWER	DC 9V Battery
BATTERY LIFE	Approx. 200 Hours (Alkaline Battery) 100 Hours (Carbon Zinc Battery)
POWER CONSUMPTION	3-4mA
OPERATING ENVIRONMENT	0℃ – 40℃ (32℉ – 104℉) less than 85% RH
DIMENSIONS	180L x 82W x 38H mm (7.1"L x 3.2"W x 1.5"H)
WEIGHT	280g. (9.9 oz.) including battery.
ACCESSORIES	Test leads 1 pair Spare Fuse (0.2A) 1 pc. 9V Battery 1 pc. Instruction manual 1 pc.

ELECTRICAL SPECIFICATION

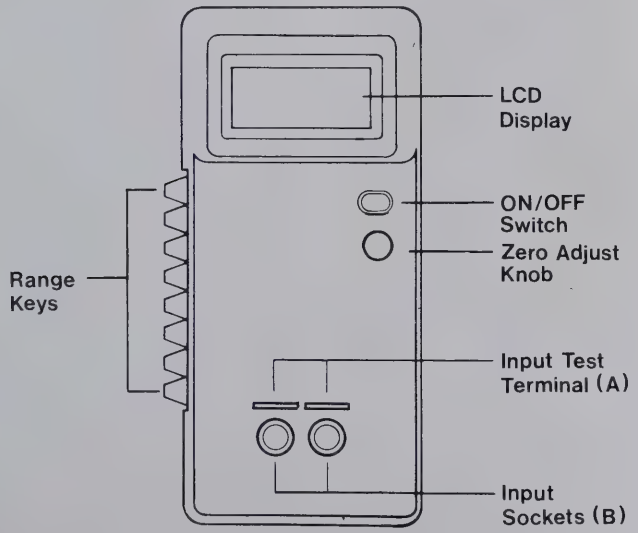
ACCURACY (25℃ ±5℃): 0.5% of full scale ±1 LSD.
(least significant digit) on 200PF to 200uF range.
1% of full scale ±1 LSD on 2000uF range.

ZERO ADJUSTMENT PROTECTION: A fuse (0.2A) protects against damage from charged capacitors that are more than DC50 Volts.

NORMAL RANGE	MAX. IN-RANGE DISPLAY	RESOLUTION	TEST FREQUENCY
200 PF	199.9 pF	0.1 pF	800 Hz
2 nF	1.999 nF	1 pF	800 Hz
20 nF	19.99 nF	10 pF	800 Hz
200 nF	199.9 nF	100 pF	800 Hz
2 uF	1.999 uF	1000 pF	800 Hz
20 uF	19.99 uF	0.01 uF	80 Hz
200 uF	199.9 uF	0.1 uF	8 Hz
2000 uF	1999 uF	1 uF	8 Hz

IDENTIFICATION AND OPERATION OF CONTROLS

READOUT	Big, clear, high-contrast 3½ digit LC Display with "LOBAT" sign.
ON/OFF SWITCH	Switch off the power when the meter is not in use.
RANGE KEYS	There are 8 switches for selecting the range to be measured. Depressing one switch automatically releases another in the set of eight.
RANGE SCALE	The maximum display is 1999 in each case.
ZERO ADJUST KNOB	Adjust the display to zero value before measurement (max ±20pF)
TEST SOCKET	A) For neutral capacitors or small size polarized capacitors such as Tan. Cap. etc. B) Specified for larger size polarized capacitors.
BATTERY SNAP	This meter is using one DC9V battery, do attend the polarities when installing battery.

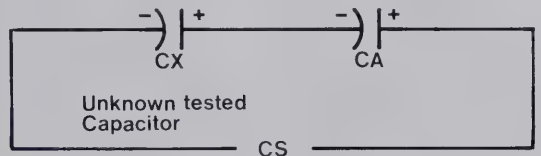


OPERATING INSTRUCTION

1. Turn the power on.
2. Select the desired range.
3. Adjust the display to zero value (if using the test leads for measuring, insert the test lead first).
4. Insert the capacitor to the input test terminal or you can use the test leads for the large capacitor.
5. Read the display. The actual value in the electrical unit (pF, nF, uF) indicated at the selected key.
6. If the capacitance value is unmarked, start with the 200pF range and keep increasing until the over-range indication goes off and the reading is obtained.
7. Please note a shorted capacitor will show over-range on all ranges. A capacitor with low voltage leakage, will read over-range or much higher value then normal.
8. The capacitors usually have wide tolerance, especially the electrolytics type. Do not be surprised if the measured value is greater than the value marked on the capacitor.

LARGE CAPACITANCE MEASUREMENT

1. For measuring a large capacitance capacitor, select a known value capacitor (over 1000uF, close to 2000uF is the best). The value of this capacitor is CA.
2. Connect the capacitor (unknown value CX) in series with the known value capacitor (CA).



3. Measure the value of the "serial" capacitors (CS).
4. Then the value of the "CX" can be calculated by the following formula.

$$CX = \frac{CA \times CS}{CA - CS}$$

CAUTION

1. Connect battery polarities correctly.
2. Observe polarity when connecting polarized capacitors.
3. Fully discharge the capacitor before test.
4. Never apply voltage to the test socket. This is due to the risk of damaging the unit.
5. Do not short the test leads together.
6. Do not depress two or more switches simultaneously.

CONVERSION TABLE

pF	nF	uF	FARAD
1,000	1.0	0.001	
10,000	10.0	0.01	
100,000	100.0	0.1	
1,000,000	1,000.0	1.0	
	10,000	10.0	
	100,000	100.0	
	1,000,000	1000.0	0.001
		10,000.0	0.01

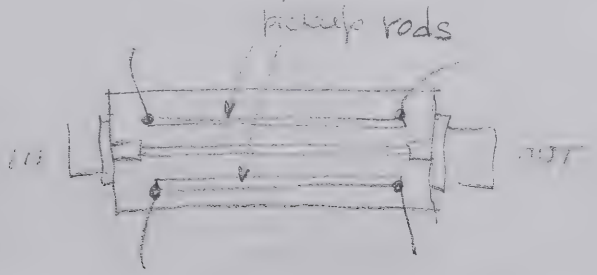
pF = picofarads (10^{-12}) nF = nanofarads (10^{-9})
uF = microfarads (10^{-6}) mF = millifarads (10^{-3})

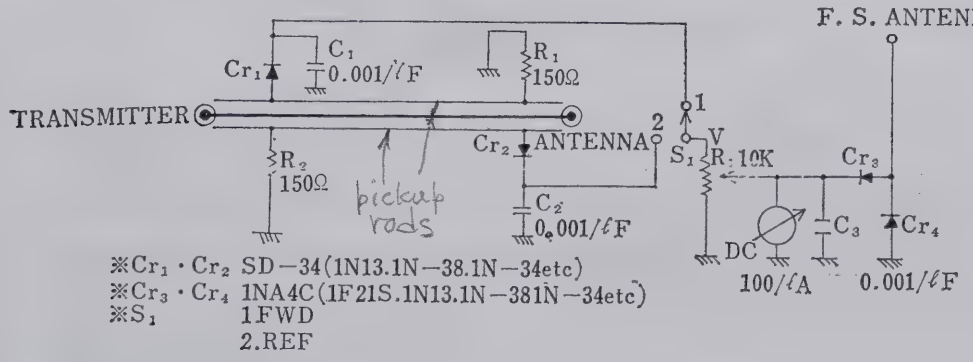
TYPICAL CAPACITOR CHARACTERISTICS

TYPE	VALUE	VOLTAGE	TEMPCO	DF	DA	LEAKAGE
Glass and Mica						
Glass	0.5 pF – .01 uF	300 – 1 kv	±140 ±25	.03 – 0.1%		10^9
High K Glass	10 pF – .01 uF	50 – 100	±4500	1 – 3%		10^3
Mica	1 pF – .01 uF	100 – 2 kv	±500 to ±10	.05 – 0.2%	0.7%	$10^3 - 10^{11}$
Ceramic						
COG	1 pF – 0.1 uF	50 – 600	0 ±30	0.2%		10^5
COH	1 pF – .01 uF	50 – 600	0 ±60	0.2%		10^5
COJ	1 pF – .01 uF	50 – 600	0 ±120	0.2%		10^5
COK	1 pF – .01 uF	50 – 600	0 ±250	0.2%		10^5
P3K	100 pF – .01 uF	50 – 600	– 1500 ±250	0.2%		10^5
S2L	3 – 200 pF	1 kv – 6 kv	– 330 ±500	0.6%		10^4
S3N	3 – 200 pF	1 kv – 6 kv	– 3300 ±2500	0.6%		10^4
U2J	1 pF – .01 uF	50 – 600	– 1500 ±250	0.2%		10^5
X5F	100 pF – .01 uF	50 – 600	– 500 ±2500	2%		$10^3 - 10^{10}$
X5U	100 pF – .01 uF	60 – 6 kv	±2000	2%		$10^3 - 10^9$
X7R	10 pF – 2.7 uF	50 – 100	±1000 ±3000	2.5%		$10^3 - 10^8$
Y5F	.01 – 2.2 uF	3 – 50	±2500	2 – 10 %		$10^3 - 10^8$
Y5R	.01 – 2.2 uF	3 – 5u	±3000	2 – 10%		$10^3 - 10^8$
Y5T	.01 – 2.2 uF	3 – 50	±1000 ±4000	2 – 10%		$10^3 - 10^8$
Y5V	470 pF – 4.7 uF	50 – 100	±20,000	2.5%		10^3
Z5F	100 pF – .01 uF	50 – 6 kv	±2000	2%		$10^4 - 10^{10}$
Z5P	.001 – .01 uF	50 – 6 kv	±2500 ±2500	2%		$10^4 - 10^{10}$
Z5R	.005 – 0.1 uF	50 – 6 kv	±2500 ±2500	2%		$10^4 - 10^{10}$
Z5U	.001 – 4.7 uF	50 – 6 kv	±10,000	2%		$10^4 - 10^{10}$
Z5V	.001 – 0.1 uF	50 – 600	±10,000	2%		$10^4 - 10^{10}$
Paper and Plastic						
Mylar	.001 – 10 uF	50 – 1600	±400 ±200	0.5 – 1%	0.5%	$10^9 - 10^{11}$
Paper	.0005 – 100 uF	200 – 15 kv	0 ±500	0.2 – 1%	2%	$10^9 - 10^{10}$
Parylene	.001 – 1 uF	30 – 100	0 ±50 – 200	0.1 – 0.3%	0.1 – 1%	$10^{10} - 10^{12}$
Polycarbonite	.001 – 25 uF	50 – 400	0 ±100	0.1 – 0.5%	0.2%	$10^{10} - 10^{11}$
Polystyrene	20 nF – 30 uF	30 – 600	– 120 ±30	.01 – 0.1%	.02%	$10^{11} - 10^{12}$
Teflon	.001 – 1 uF	50 – 600	– 200	0.1 – 0.2%	0.2%	$10^{11} - 10^{12}$
Electrolytic						
Aluminum Foil	0.5 uF – 1 F	3 – 500	+ 10,000	3 – 50%	10%	.01 – 10 uA
Tantalum Foil	0.1 – 10,000 uF	3 – 500	+ 2500	10 – 20%		.01 – 1 uA
Solid Tantalum	.001 – 1000 uF	3 – 125	+ 1000	1 – 12%	2%	.01 – 10 uA

TEMPCO = temperature coefficient in ppm per °C
DF = dissipation factor @ 1 KHz, except electrolytics @ 120 Hz, Mica @ 1 MHz.
DA = dielectric absorption.
LEAKAGE = ohms x uF, except electrolytics = uA per uFV.

MADE IN HONG KONG





※Cr_1 · Cr_2 SD−34(1N13.1N−38.1N−34etc)
※Cr_3 · Cr_4 1NA4C(1F21S.1N13.1N−381N−34etc)
※S_1 1.FWD
2.REF

WARNING: SEVERE DAMAGE CAN OCCUR IF THE GAIN IS SET TOO HIGH WHEN POWER IS APPLIED.

ALLIED RADIO SHACK A TANDY CORPORATION COMPANY
FORT WORTH, TEXAS 76107

PRINTED IN JAPAN

ARCHER

STANDING WAVE BRIDGE FIELD STRENGTH INDICA

CAT. NO. 21-575

CUSTOM MANUFACTURED FOR
ALLIED RADIO SHACK A TANDY CORPORATION COMPANY

RADIO SHACK STANDING WAVE BRIDGE AND FIELD STRENGTH INDICATOR

This is a compact, accurate device with which the amateur radio or CB operator can easily check transmitter operation. For SWR measurements, it uses the bridge method of comparing the power supplied to the antenna system with the power reflected from it. Operating the indicator is simple, and matching the transmitter with the antenna is quickly done. Transmitter output can be monitored continuously by leaving the indicator in the circuit. The indicator can also be used as a field strength meter by disconnecting it from the feedline and attaching to it the small pickup antenna included in this package.

SPECIFICATIONS

SWR: 1:1 to 1:3
Accuracy: 5%
Impedance: 52 ohms
Indicator: 100 DC microammeter
Antenna (full length): 9¼"
Dimensions: 6 x 2 x 2"
Weight: 14 oz.

OPERATION: SWR Measurement

1. Turn the transmitter off and disconnect the antenna's coaxial cable at the transmitter output.
2. Connect the indicator's ANTENNA jack (on top of case) with the disconnected coaxial cable of the transmitter antenna. Next, using a short coaxial cable with male connectors (PL-259A) at either end, connect the indicator's TRANSMITTER jack (bottom of case) with the transmitter output.
3. Set the center switch to FWD and rotate the sensitivity control knob above it counterclockwise to near minimum position.
4. Turn the transmitter on and rotate the sensitivity control knob for full meter swing.
5. Next, set the switch to REF and read the indication on the SWR (top) scale.
6. A 1:1 ratio is the theoretically ideal match. The transmitter and its antenna should be adjusted so that the SWR is as low as possible. Considering line losses and slight mismatching, an SWR of 1.5 is considered satisfactory. (The operator is referred to the many articles in radio magazines and books dealing with the proper matching of different kinds of antennas).
7. The power required for SWR bridge operation depends on the frequen 25 watts at 3.5 MC, 15 watts at 7 MC, and proportionally lower powers frequencies. If the transmitter power is low and a full meter swing cannot b in step 5, adjust the transmitter and its antenna for the lowest possible sw REF position of the indicator switch.

IN-CIRCUIT MONITORING

The indicator can be left continuously in the circuit for monitoring transmitt up to 1 KW. Set the switch to FWD and adjust the sensitivity control knob f swing that is about mid-scale when the transmitter is on. Any abnormal variat transmitting unit will be quickly registered by the needle. As an in-circuit m indicator consumes almost no power.

FIELD STRENGTH INDICATIONS

This indicator is designed to determine comparative RF field strength. A pair in the circuit rectify the energy sensed by the pickup antenna.

1. Remove the indicator from the transmitter output circuit and replace all th transmitter antenna connections.
2. Set the indicator switch to FWD.
3. Screw the 5-section telescopic pickup antenna into the terminal on top o and extend it full length.
4. Bring the indicator within range of the transmitter, or its antenna, while mitter is operating. Be careful that the pickup antenna does not touch any of the transmitting unit.
5. Rotate the sensitivity control knob on the front panel to obtain a meter readi there are strong RF fields, shorten the antenna.

After these steps have been taken, any adjustments performed on the transm antenna will be reflected by an increase or decrease on the F.S. (bottom) sc indicator.

PERCENTAGE POWER OUTPUT

The (%) REF POWER center sca meter allows the operator to calculat tage output of the transmitter.

CAUTION: SEVERE DAMAGE CAN OCCUR IF THE GAIN TOO HIGH WHEN POWER IS APPLIED.

Cat. No. 21-524

OWNER'S MANUAL

Please read before using this equipment

SWR/Power Meter

RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 90 days from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

EXCEPT AS PROVIDED HEREIN, RADIO SHACK MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITENSS FOR A PARTICULAR PURPOSE. Some states do not permit limitation or exclusion of implied warranties; therefore, the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state

We Service What We Sell

RADIO SHACK
A Division of Tandy Corporation
Fort Worth, Texas 76102

811023720B
Printed in Hong Kong

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Radio Shack®

INTRODUCTION

Your Radio Shack Standing Wave Ratio and Power Meter helps you tune your CB or amateur radio system for best performance. CB and amateur radio systems work best when the antenna system's impedance matches the transmitter's output impedance as closely as possible.

The standing wave ratio (SWR) function helps you adjust your antenna to the precise length for maximum transmitted power. The power meter function measures either the peak envelope power (PEP) or average power from your transmitter.

This meter's output and input impedances are 50 ohms.

NOTES

SPECIFICATIONS

Frequency Range	3 MHz – 30 MHz
Input RF Power	1 Watt – 2000 Watts
Impedance	50 ohms
Minimum Input Power for Calibration	1 Watt
Power Meter Accuracy at 50 ohms Load Impedance	
5W	+- 0.5W
50W	+- 5W
500W	+- 50W
SWR at 50 ohms Load Impedance	1.1
SWR at 25 ohms Load Impedance	2.0
SWR at 100 ohms Load Impedance	2.0
Dimensions	1 7/16 x 5 9/16 x 1 1/2 inches (HWD) (60 x 165 x 90 mm)
Weight	approx. 17.5 oz. (500 g)

USING THE METER

CONNECTING THE METER

Follow these steps to connect the meter to your transmitter:

1. Disconnect the antenna cable from the transmitter's antenna terminal. Then, connect the antenna cable to the meter's **ANT** terminal.

   If you will perform a test using a 50-ohm dummy load instead of an antenna, connect the dummy load to the meter's **ANT** terminal.

2. Connect a short 50-ohm cable, such as type RG-58U, between the transmitter's antenna terminal and the meter's **TRANS** terminal.

MEASURING STANDING WAVE RATIO

Follow these steps to measure your transmitter system's SWR.

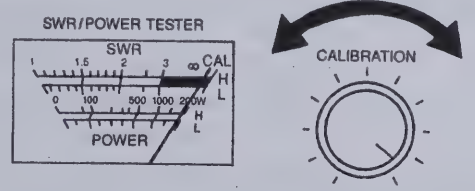
1. Set **FUNCTION** to **CAL**.

2. Select a channel and press the transmit key on the transmitter. Do not speak into the microphone while you make this measurement.

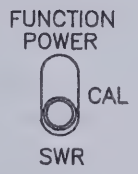
   Note: If you use a CB that has side band modes, do not use the side band modes for this measurement. If you have an amateur radio, use the CW mode to

check the SWR. See the ARRL Handbook, available at your local library, for more information about measuring SWR.

3. While the signal transmits, rotate **CALIBRATION** until the meter's needle aligns with **CAL**.



4. Set **FUNCTION** to **SWR**.



5. Transmit a signal from the transmitter again, as in Step 2.
6. Read the needle position on the **SWR** scale.
   If the transmitter's power is less than 20 watts, read the **SWR L** scale. For over 20 watts, read the **SWR H** scale.
   Refer to the next section to interpret the reading.
7. Repeat Steps 2-6 for each channel or frequency you want to measure.

CARE AND MAINTENANCE

Your Radio Shack Standing Wave Ratio and Power Meter is an example of superior design and craftsmanship. The following suggestions will help you care for the meter so that you can use it for years.

Keep the meter dry. If it does get wet, immediately wipe it dry. Liquids can contain minerals that corrode the electronic circuits.

Handle the meter gently and carefully. Dropping it can damage its circuit board and case and can cause it to work improperly.

Use and store the meter only in normal temperature environments. Temperature extremes can shorten the life of electronic devices and distort or melt plastic parts.

Keep the meter away from dust and dirt, which can cause premature wear of parts.

Occasionally wipe the meter with a dampened cloth to keep it looking new. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the meter.

Modifying or tampering with the meter's internal components can cause a malfunction and might invalidate the meter's warranty. If the meter is not operating as it should, take it to your local Radio Shack store so that our personnel can arrange for service, if needed.

4. Select a desired channel and transmit a signal. Do not talk into the microphone during the measurement.

   If your transmitter is a single-side band type, to properly measure SSB output power, connect a low-frequency oscillator to the transmitter, and input a 1000Hz-to-1500Hz tone signal from the oscillator. This procedure should be performed by a qualified technician.

5. Read the needle position on the **POWER** scale. The meter shows the forward power of the transmitter.

   When you set the **RANGE** switch to **20W**, read the lower **POWER** scale.

6. If the reading is extremely low within the selected range, set **RANGE** to a lower position and read the scale again.

INTERPRETING THE READINGS

An ideal SWR reading is 1.0, or a meter reading of 1 on the **SWR** scale. This measurement is possible only under laboratory conditions or with a dummy load. Actual antenna installations have higher readings. Use the following chart to interpret the readings you obtain.

SWR	EFFICIENCY	INTERPRETATION
1.0 to 1.5	Excellent	The antenna cable and the antenna length match the transmitter's output requirements almost perfectly.
1.5 to 2.0	Very Good	The antenna, the cable and the transmitter operate very efficiently.
2.0 to 3.0	Acceptable	The antenna system easily puts out enough power for normal operation.
Above 3.0	Inefficient	Adjust your antenna or antenna mounting system to improve operation.

Note: The SWR is different for different frequencies. If you measure the SWR on several different channels or frequencies, you get different readings. If you usually transmit on one channel more than the others, make your readings on that channel and fine-tune the system

for that channel. If you use all the channels without preference, make your readings on a channel centered within the band you use. For example, if you use all 40 CB channels, make your reading on Channel 19, because it is midway between Channel 1 and Channel 40

The figures below the SWR values in the following chart indicate the percentage of power that reflected back to the transmitter. For example, an SWR reading of 1.5 also means that 4% of your signal power is lost. However, 96% of the transmitter power is more than enough for almost all applications.

SWR	1.0	1.1	1.2	1.5	2.0	2.5	3.0
REF POWER (%)	0	0.22	0.8	4.0	11.1	18.4	25.0

Improving the SWR Readings

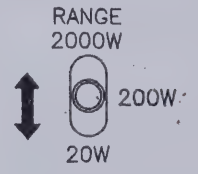
There are three ways to improve your system's SWR. Try the simplest first.

- Be sure you are using the cable recommended for your equipment. If the manufacturer recommends a 50-ohm cable, do not substitute another type that has a different impedance.
- Be sure that you mounted your antenna according to the manufacturer's instructions. The angle and the base arrangement can affect the SWR reading.
- Adjust the length of your antenna according to the instructions provided by the manufacturer. A change of 1/8 inch can make a measurable difference.

MEASURING POWER OUTPUT

Follow these steps to measure your transmitter's power output:

1. Set **FUNCTION** to **POWER**.
2. Set **RANGE** to an appropriate position according to the transmitter's rated power.

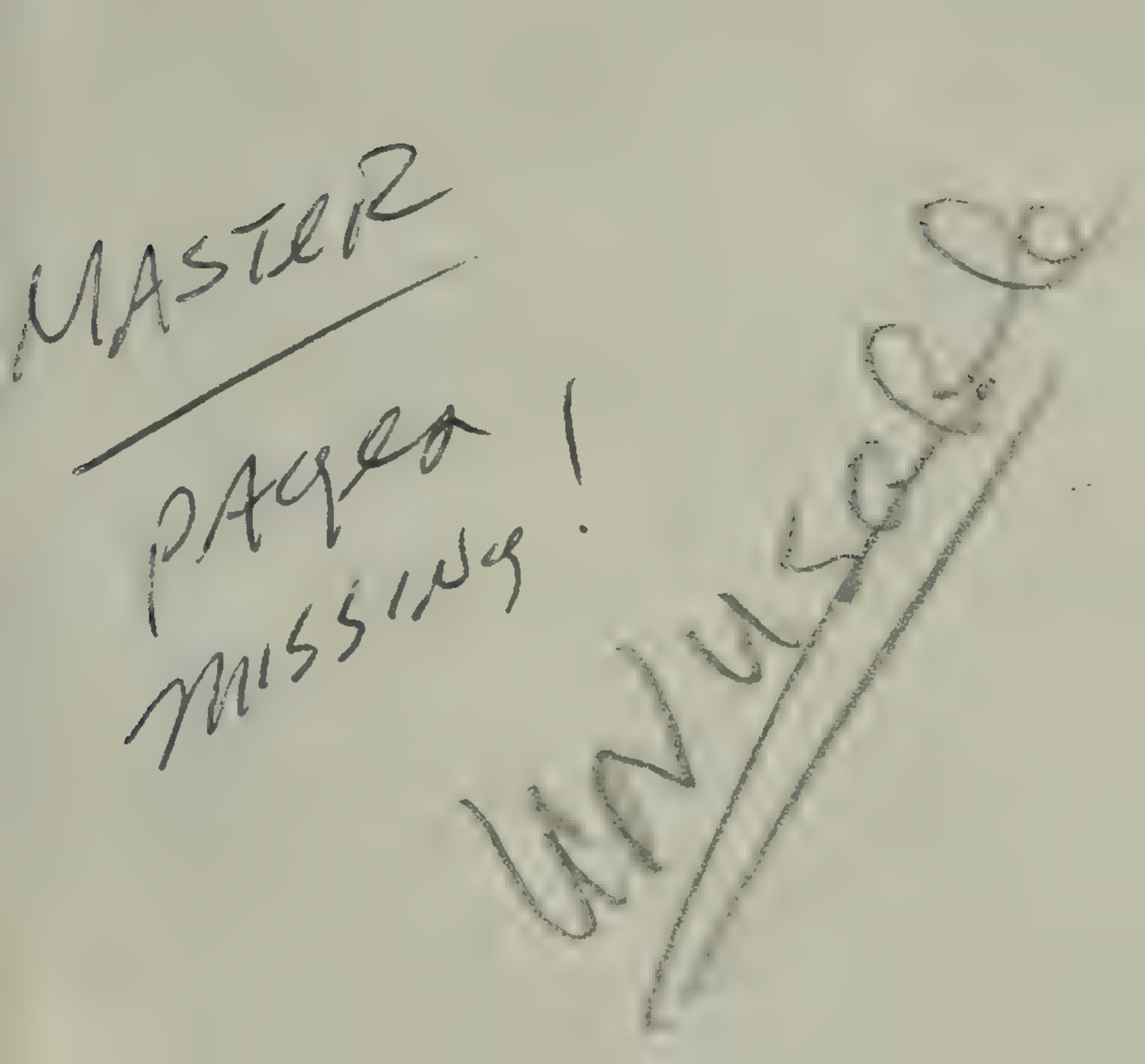


If you do not know the rated power, set **RANGE** to **2000W**.

3. If your transmitter is a single-sideband (SSB) or continuous-wave (CW) type, set the **MODE** switch to **PEP** to measure the peak-envelope power, or to **AVG** to measure the average power. See the ARRL Handbook, available at your local library, for more information on measuring power.

MASTER

PAGES MISSING!



Cat. No. 22-211A

OWNER'S MANUAL

Please read before using this equipment.

Folding Multitester

Radio Shack®

FEATURES

This Radio Shack Folding Multitester is designed to measure AC and DC voltages, DC current, and resistance with accuracy and ease. This small, light instrument provides years of accurate measurement. The multitester is powered by one AA battery (not supplied) and includes these features.

Single Knob Function Control — makes the multitester easy to use and read.

Mirrored Three-Color Scale — provides accurate and rapid scale identification.

Folding Case — protects the multitester during transit. When the case is closed, the meter's movement is shunted to further protect it.

Protective Fuse — protects the delicate meter movement and other internal parts in case of inadvertent overload or improper function selection.

Hinge-Joint with Detent — lets you position the operating and indicating sections for easy reading in all positions, whether hand-held or bench-top.

Insulated Test Leads with Banana-Type Plugs — result in firm, safe, low resistance measurements.

SPECIFICATIONS

Ranges:	25
DC Voltage:	0–0.6–3–15–60–300–600–1200V
AC Voltage:	0–15–60–150–600–1200V
DC Current:	0–60 μA–3–30–300mA
Resistance:	0– 2K, 0–20K, 0–200K, 0–2 Meg. (center scale 24)
Decibels:	–20 to +63 dB in 5 ranges
Output:	0–15–60–150–600V
Accuracy (at horizontal position):	
	±3% of full-scale, DC voltage and current
	±4% of full-scale, AC voltage
	±3% of scale-length, resistance
Influence of Scale Angle (at vertical position):	
	±2% of full scale
Sensitivity:	20,000 ohms/volt DC
	10,000 ohms/volt AC
Meter Movement:	4 inches (10 cm), 3-color mirrored scale, 37 μA movement
Detent:	90, 120, 150, 180 degrees
Battery:	Requires one type AA penlight cell for ohms function
Leads:	44 inches (110 cm)
	Banana-style plug
Fuse:	0.5A, 250V fast-acting, 5x20 mm type
Size:	
Fully Open:	$7^{5}/_{16}$ x $4^{3}/_{8}$ x $1^{5}/_{16}$ inches (HWD)
	(18.4 x 11 x 3.3 cm)
Fully Closed:	4 x $4^{3}/_{8}$ x $2^{1}/_{2}$ inches (HWD)
	(10 x 11 x 6.3 cm)
Weight:	0.8 lbs (350 g)

READ BEFORE USE

SPECIAL MARKINGS

We have placed the following special markings on the multitester to remind you of important safety precautions.


Refer to the following operating instructions.


To avoid electrical shock and/or instrument damage, do not connect the common input terminal (–jack) to any source of more than 500 volts with respect to earth/ground.

SAFETY PRECAUTIONS

We have taken every precaution in designing this multitester to ensure that it is as safe as we can make it. But, safe operation depends on you, the operator. We recommend you follow these safety rules.

WARNING! USE THIS DEVICE WITH EXTREME CAUTION. IMPROPER USE CAN RESULT IN INJURY OR DEATH. FOLLOW ALL SAFEGUARDS SUGGESTED IN THE OWNER'S MANUAL IN ADDITION TO NORMAL SAFETY PRECAUTIONS IN DEALING WITH ELECTRICAL CIRCUITS. DO NOT USE THIS DEVICE IF YOU ARE UNFAMILIAR WITH ELECTRICAL CIRCUITS AND TESTING PROCEDURES. NOT FOR COMMERCIAL OR INDUSTRIAL USE.

- There is always the possibility that dangerous voltage is present in any piece of electrical/electronic equipment. Always use extreme caution when making measurements; high voltage might appear at unexpected points in a suspected defective circuit.

- When making measurements, never stand on a wet or damp floor. Do not work near (or on) any grounded metal object — for example, a metal work table, metal water or gas pipes, or metal electrical conduit. Accidental contact between the grounded metal object and the circuit under test can be lethal.
- Always use only well-insulated test leads. Never use test leads with frayed or broken insulation; voltages appear at all exposed contact points on the leads.
- Use only the same type of test leads as those supplied with your unit. These test leads are rated for 1200 volts; replacement leads are available from your local Radio Shack store.
- Never use test leads without insulated test probes. Never allow your fingers to touch the bare metal part of the test probes (or circuit points).
- Never attempt to measure voltages or currents above the specified maximum the multitester is designed for; refer to the specifications section.
- For safety's sake, disconnect leads as soon as you've completed measurements.
- Always turn off the unit's power before connecting test leads. This is especially true when working on circuits with 100 or more volts.
- Get into the habit of keeping one hand in your pocket when trouble-shooting any equipment containing high-voltage circuitry. Using only one hand decreases the chance of electric shock.

- Remember that even a small shock can be dangerous. Your body's reaction to a minor shock can cause you to bump or fall against a higher-voltage contact.
- Discharge filter capacitors before connecting test leads; such capacitors can retain hazardous charges in units with high-voltage circuits.
- When making voltage and current measurements, always start with the highest available range.
- Never attempt to measure a voltage when the function is set to resistance or current. Doing so could burn out the meter movement or other circuitry. Never attempt to measure current with the meter set for resistance.
- Never attempt to measure AC voltages or current with the meter set to a DC mode (meter circuitry might be damaged).
- Do not attempt to measure RF voltages with the meter. This might damage the meter or, at best, give false readings.

INSTALLING THE BATTERY

WARNING! TO AVOID ELECTRIC SHOCK, DISCONNECT THE TEST PROBES BEFORE REMOVING THE BATTERY OR THE FUSE. REPLACE ONLY WITH THE REQUIRED TYPE OF BATTERY OR FUSE. DO NOT REMOVE THE TOP COVER. SERVICE SHOULD BE PERFORMED ONLY BY QUALIFIED PERSONNEL.

Press the latch on the multitester's front case to open it. Remove the battery cover and install one AA battery as indicated by the polarity symbols (+ and –) marked inside the compartment. For the longest life, we recommend an alkaline battery (Radio Shack Cat. No. 23-557). Then replace the battery cover.

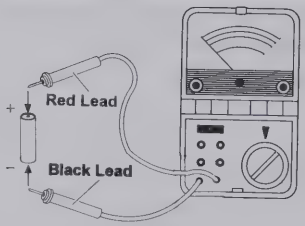
WARNING! NEVER OPERATE YOUR MULTITESTER UNTIL THE BATTERY COMPARTMENT COVER IS FULLY CLOSED.

When you cannot adjust the pointer to 0 on the OHMS range, replace the battery. Never leave a weak or dead battery in the multitester. Even a *leak-proof* battery might leak damaging chemicals. Also, if you are not going to use the multitester for a week or more, remove the battery.

MEASUREMENT TIPS

- For the most accurate readings, keep the multitester lying flat on a non-metallic surface. Use a range setting that results in a reading in the upper third of the meter scale.
- Look at the scale from the point where the pointer and its mirror reflection come together; otherwise, your reading will be inaccurate due to parallax.
- The pointer may shift slightly from the 0 position as you change the angle of the meter section.
- If the pointer does not normally rest exactly over the 0 at the left side of the scale, adjust the plastic screw in the lower center of the meter face to bring the needle to 0.
- Remember that you measure voltage and resistance with the multitester connected in parallel. Measure current with the multitester connected in series.

PARALLEL METER CONNECTION



lead colors. The red lead is the negative source. The black lead is positive.

MEASURING DC CURRENT

WARNING! DO NOT APPLY VOLTAGE TO THE MEASURING TERMINAL WHILE THE RANGE SWITCH IS IN THE CURRENT POSITION.

1. Plug the test leads into the correct jacks.
2. Set the range switch to the 300m DCA position (300 milliamp). Always start at the top and work down.
3. Open the circuit in which you want to measure the current and connect the black lead to the negative side and the red lead to the positive side of the circuit.
4. Apply power to the circuit under test and read the current on the black DC scales.

MEASURING DECIBELS

1. Plug the test leads into the correct jacks.
2. Set the range switch to one of the ACV ranges.
3. For a range switch setting of 15 ACV, read dB directly on the bottom scale in dB. For other settings of the range switch, add the appropriate number of dB to the dB scale reading as noted on the chart at the lower right on the meter face.

Note: For absolute dB measurements, circuit impedance must be 600 ohms. 0 dB = 1 milliwatt dissipated in a 500 ohm impedance (equivalent to 0.775 volts across 600 ohms).

MEASURING OUTPUT VOLTAGE

1. To measure AC voltage in the presence of DC voltage, use the output function. Connect the black lead to the ⊖ COM jack and the red lead to the OUTPUT jack.
2. Set the range switch to an ACV position and measure the voltage in the circuit.

   Note: The output function incorporates a DC blocking capacitor, rated at 600 volts. Do not exceed the 600 volt rating when measuring output voltages.
3. Read output voltages on the same scales as for AC voltage.

CARING FOR THE MULTITESTER

Your Radio Shack Folding Multitester is an example of superior design and craftsmanship. The following suggestions will help you care for the multitester so you can enjoy it for years.

- Avoid vibration or mechanical shock to the multitester.
- Avoid using the multitester in areas with high magnetic fields (such as near a transformer or motor). Inaccurate measurements can result.
- Keep the multitester dry. If it gets wet, wipe it dry immediately. Liquids might contain minerals that can corrode the electronic circuits.
- Use and store the multitester only in normal temperature environments. Temperature extremes can shorten the life of electronic devices, damage batteries, and distort or melt plastic parts.
- Handle the multitester gently and carefully. Dropping it can damage the circuit boards and can cause it to work improperly.
- Keep the multitester away from dust and dirt, which can cause premature wear of parts.
- Wipe the multitester with a damp cloth occasionally to keep it looking new. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the meter.
- Use only a fresh battery of the recommended size and type. Always remove an old or weak battery. It can leak chemicals that might destroy electronic circuits.

Modifying or tampering with the multitester's internal components can cause a malfunction and might invalidate its warranty. If your multitester is not performing as it should, take it to your local Radio Shack store for assistance.

The multitester is fully calibrated and tested. Under normal use, no further adjustment is necessary. If the multitester requires adjustment, do not attempt to do so yourself. Take it to your nearest Radio Shack store for assistance. Unauthorized service voids the multitester's warranty.

REPLACING THE FUSE

WARNING! TO AVOID ELECTRIC SHOCK, DISCONNECT THE TEST PROBES BEFORE REMOVING THE BATTERY OR THE FUSE. REPLACE ONLY WITH THE SAME TYPE OF BATTERY OR FUSE. DO NOT REMOVE THE TOP COVER. SERVICE SHOULD BE PERFORMED ONLY BY QUALIFIED PERSONNEL.

Replace your multitester's fuse only with a fuse of the same type/rating (0.5A, 250V, Radio Shack Cat. No. 270-1047).

1. Disconnect the test leads.
2. Open the battery compartment cover.
3. Pull the red ribbon in the fuse compartment so the fuse pops out.
4. Insert a new fuse on the ribbon ring.
5. Install the fuse with the ribbon in the fuse compartment.

6. Close the battery compartment cover.

WARNING! NEVER OPERATE YOUR MULTITESTER UNTIL THE BATTERY COMPARTMENT COVER IS FULLY CLOSED.

Note: There is space in the battery fuse compartment for a spare fuse so you can have a replacement handy.

NOTES

RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 90 days from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

EXCEPT AS PROVIDED HEREIN, RADIO SHACK MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Some states do not permit limitation or exclusion of implied warranties; therefore, the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

We Service What We Sell

RADIO SHACK
A Division of Tandy Corporation
Fort Worth, Texas 76102

811090670D
1A4 Printed in Hong Kong

Cat. No. 22-211A
OWNER'S MANUAL

Please read before using this equipment.

Folding Multitester

RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 90 days from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

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We Service What We Sell

Radio Shack®

RADIO SHACK
A Division of Tandy Corporation
Fort Worth, Texas 76102

1A4

811090670D
Printed in Hong Kong

FEATURES

This Radio Shack Folding Multitester is designed to measure AC and DC voltages, DC current, and resistance with accuracy and ease. This small, light instrument provides years of accurate measurement. The multitester is powered by one AA battery (not supplied) and includes these features.

Single Knob Function Control — makes the multitester easy to use and read.

Mirrored Three-Color Scale — provides accurate and rapid scale identification.

Folding Case — protects the multitester during transit. When the case is closed, the meter's movement is shunted to further protect it.

Protective Fuse — protects the delicate meter movement and other internal parts in case of inadvertent overload or improper function selection.

Hinge-Joint with Detent — lets you position the operating and indicating sections for easy reading in all positions, whether hand-held or bench-top.

Insulated Test Leads with Banana-Type Plugs — result in firm, safe, low resistance measurements.

NOTES

SPECIFICATIONS

Ranges:	25
DC Voltage:	0–0.6–3–15–60–300–600–1200V
AC Voltage:	0–15–60–150–600–1200V
DC Current:	0–60 µA–3–30–300mA
Resistance:	0– 2K, 0–20K, 0–200K, 0–2 Meg. (center scale 24)
Decibels:	–20 to +63 dB in 5 ranges
Output:	0–15–60–150–600V
Accuracy (at horizontal position):	
	±3% of full-scale, DC voltage and current
	±4% of full-scale, AC voltage
	±3% of scale-length, resistance
Influence of Scale Angle (at vertical position):	
	±2% of full scale
Sensitivity:	20,000 ohms/volt DC
	10,000 ohms/volt AC
Meter Movement:	4 inches (10 cm), 3-color mirrored scale, 37 µA movement
Detent:	90, 120, 150, 180 degrees
Battery:	Requires one type AA penlight cell for ohms function
Leads:	44 inches (110 cm)
	Banana-style plug
Fuse:	0.5A, 250V fast-acting, 5x20 mm type
Size:	
Fully Open:	$7^{5}/_{16}$ x $4^{3}/_{8}$ x $1^{5}/_{16}$ inches (HWD) (18.4 x 11 x 3.3 cm)
Fully Closed:	4 x $4^{3}/_{8}$ x $2^{1}/_{2}$ inches (HWD) (10 x 11 x 6.3 cm)
Weight:	0.8 lbs (350 g)

READ BEFORE USE

SPECIAL MARKINGS

We have placed the following special markings on the multitester to remind you of important safety precautions.

⚠ Refer to the following operating instructions.

⏚ To avoid electrical shock and/or instrument damage, do not connect the common input terminal (–jack) to any source of more than 500 volts with respect to earth/ground.

SAFETY PRECAUTIONS

We have taken every precaution in designing this multitester to ensure that it is as safe as we can make it. But, safe operation depends on you, the operator. We recommend you follow these safety rules.

WARNING! USE THIS DEVICE WITH EXTREME CAUTION. IMPROPER USE CAN RESULT IN INJURY OR DEATH. FOLLOW ALL SAFEGUARDS SUGGESTED IN THE OWNER'S MANUAL IN ADDITION TO NORMAL SAFETY PRECAUTIONS IN DEALING WITH ELECTRICAL CIRCUITS. DO NOT USE THIS DEVICE IF YOU ARE UNFAMILIAR WITH ELECTRICAL CIRCUITS AND TESTING PROCEDURES. NOT FOR COMMERCIAL OR INDUSTRIAL USE.

- There is always the possibility that dangerous voltage is present in any piece of electrical/electronic equipment. Always use extreme caution when making measurements; high voltage might appear at unexpected points in a suspected defective circuit.

6. Close the battery compartment cover.

WARNING! NEVER OPERATE YOUR MULTITESTER UNTIL THE BATTERY COMPARTMENT COVER IS FULLY CLOSED.

Note: There is space in the battery fuse compartment for a spare fuse so you can have a replacement handy.

Modifying or tampering with the multitester's internal components can cause a malfunction and might invalidate its warranty. If your multitester is not performing as it should, take it to your local Radio Shack store for assistance.

The multitester is fully calibrated and tested. Under normal use, no further adjustment is necessary. If the multitester requires adjustment, do not attempt to do so yourself. Take it to your nearest Radio Shack store for assistance. Unauthorized service voids the multitester's warranty.

REPLACING THE FUSE

WARNING! TO AVOID ELECTRIC SHOCK, DISCONNECT THE TEST PROBES BEFORE REMOVING THE BATTERY OR THE FUSE. REPLACE ONLY WITH THE SAME TYPE OF BATTERY OR FUSE. DO NOT REMOVE THE TOP COVER. SERVICE SHOULD BE PERFORMED ONLY BY QUALIFIED PERSONNEL.

Replace your multitester's fuse only with a fuse of the same type/rating (0.5A, 250V, Radio Shack Cat. No. 270-1047).

1. Disconnect the test leads.
2. Open the battery compartment cover.
3. Pull the red ribbon in the fuse compartment so the fuse pops out.
4. Insert a new fuse on the ribbon ring.
5. Install the fuse with the ribbon in the fuse compartment.

- When making measurements, never stand on a wet or damp floor. Do not work near (or on) any grounded metal object — for example, a metal work table, metal water or gas pipes, or metal electrical conduit. Accidental contact between the grounded metal object and the circuit under test can be lethal.
- Always use only well-insulated test leads. Never use test leads with frayed or broken insulation; voltages appear at all exposed contact points on the leads.
- Use only the same type of test leads as those supplied with your unit. These test leads are rated for 1200 volts; replacement leads are available from your local Radio Shack store.
- Never use test leads without insulated test probes. Never allow your fingers to touch the bare metal part of the test probes (or circuit points).
- Never attempt to measure voltages or currents above the specified maximum the multitester is designed for; refer to the specifications section.
- For safety's sake, disconnect leads as soon as you've completed measurements.
- Always turn off the unit's power before connecting test leads. This is especially true when working on circuits with 100 or more volts.
- Get into the habit of keeping one hand in your pocket when trouble-shooting any equipment containing high-voltage circuitry. Using only one hand decreases the chance of electric shock.

- Remember that even a small shock can be dangerous. Your body's reaction to a minor shock can cause you to bump or fall against a higher-voltage contact.
- Discharge filter capacitors before connecting test leads; such capacitors can retain hazardous charges in units with high-voltage circuits.
- When making voltage and current measurements, always start with the highest available range.
- Never attempt to measure a voltage when the function is set to resistance or current. Doing so could burn out the meter movement or other circuitry. Never attempt to measure current with the meter set for resistance.
- Never attempt to measure AC voltages or current with the meter set to a DC mode (meter circuitry might be damaged).
- Do not attempt to measure RF voltages with the meter. This might damage the meter or, at best, give false readings.

CARING FOR THE MULTITESTER

Your Radio Shack Folding Multitester is an example of superior design and craftsmanship. The following suggestions will help you care for the multitester so you can enjoy it for years.

- Avoid vibration or mechanical shock to the multitester.
- Avoid using the multitester in areas with high magnetic fields (such as near a transformer or motor). Inaccurate measurements can result.
- Keep the multitester dry. If it gets wet, wipe it dry immediately. Liquids might contain minerals that can corrode the electronic circuits.
- Use and store the multitester only in normal temperature environments. Temperature extremes can shorten the life of electronic devices, damage batteries, and distort or melt plastic parts.
- Handle the multitester gently and carefully. Dropping it can damage the circuit boards and can cause it to work improperly.
- Keep the multitester away from dust and dirt, which can cause premature wear of parts.
- Wipe the multitester with a damp cloth occasionally to keep it looking new. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the meter.
- Use only a fresh battery of the recommended size and type. Always remove an old or weak battery. It can leak chemicals that might destroy electronic circuits.

Note: For absolute dB measurements, circuit impedance must be 600 ohms. 0 dB = 1 milliwatt dissipated in a 500 ohm impedance (equivalent to 0.775 volts across 600 ohms).

MEASURING OUTPUT VOLTAGE

1. To measure AC voltage in the presence of DC voltage, use the output function. Connect the black lead to the ⊖ COM jack and the red lead to the OUTPUT jack.
2. Set the range switch to an ACV position and measure the voltage in the circuit.

   Note: The output function incorporates a DC blocking capacitor, rated at 600 volts. Do not exceed the 600 volt rating when measuring output voltages.
3. Read output voltages on the same scales as for AC voltage.

INSTALLING THE BATTERY

WARNING! TO AVOID ELECTRIC SHOCK, DISCONNECT THE TEST PROBES BEFORE REMOVING THE BATTERY OR THE FUSE. REPLACE ONLY WITH THE REQUIRED TYPE OF BATTERY OR FUSE. DO NOT REMOVE THE TOP COVER. SERVICE SHOULD BE PERFORMED ONLY BY QUALIFIED PERSONNEL.

Press the latch on the multitester's front case to open it. Remove the battery cover and install one AA battery as indicated by the polarity symbols (+ and –) marked inside the compartment. For the longest life, we recommend an alkaline battery (Radio Shack Cat. No. 23-557). Then replace the battery cover.

WARNING! NEVER OPERATE YOUR MULTITESTER UNTIL THE BATTERY COMPARTMENT COVER IS FULLY CLOSED.

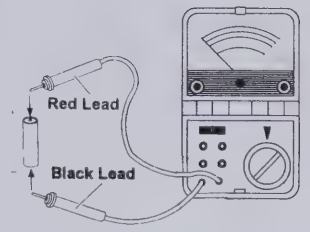
When you cannot adjust the pointer to 0 on the OHMS range, replace the battery. Never leave a weak or dead battery in the multitester. Even a *leak-proof* battery might leak damaging chemicals. Also, if you are not going to use the multitester for a week or more, remove the battery.

MAKING MEASUREMENTS

MEASUREMENT TIPS

- For the most accurate readings, keep the multitester lying flat on a non-metallic surface. Use a range setting that results in a reading in the upper third of the meter scale.
- Look at the scale from the point where the pointer and its mirror reflection come together; otherwise, your reading will be inaccurate due to parallax.
- The pointer may shift slightly from the 0 position as you change the angle of the meter section.
- If the pointer does not normally rest exactly over the 0 at the left side of the scale, adjust the plastic screw in the lower center of the meter face to bring the needle to 0.
- Remember that you measure voltage and resistance with the multitester connected in parallel. Measure current with the multitester connected in series.

PARALLEL METER CONNECTION



lead colors. The red lead is the negative source. The black lead is positive.

MEASURING DC CURRENT

WARNING! DO NOT APPLY VOLTAGE TO THE MEASURING TERMINAL WHILE THE RANGE SWITCH IS IN THE CURRENT POSITION.

1. Plug the test leads into the correct jacks.
2. Set the range switch to the 300m DCA position (300 milliamp). Always start at the top and work down.
3. Open the circuit in which you want to measure the current and connect the black lead to the negative side and the red lead to the positive side of the circuit.
4. Apply power to the circuit under test and read the current on the black DC scales.

MEASURING DECIBELS

1. Plug the test leads into the correct jacks.
2. Set the range switch to one of the ACV ranges.
3. For a range switch setting of 15 ACV, read dB directly on the bottom scale in dB. For other settings of the range switch, add the appropriate number of dB to the dB scale reading as noted on the chart at the lower right on the meter face.

Cat. No. 22-215

OWNER'S MANUAL

Please read before using this equipment.

Range Doubler Multitester

Radio Shack®

FEATURES

Your Radio Shack Range Doubler Multitester is a high-sensitivity analog multitester, ideally suited for field, lab, shop, and home applications. These features make the multitester easy to use and ensure accurate and reliable operation.

Range Doubler Switch — effectively doubles the number of available AC and DC scales for greater accuracy.

Low DC Ranges — 125 mV and 25 µA — great for solid state work.

Sensitive 18 µA Meter Movement with 4½-Inch Face and Mirrored Scale — simplifies accurate reading.

Built-In Diodes and Fuse — protect meter movement and other internal parts in case of improper function selection.

Audible Continuity Function — built-in buzzer sounds when there is continuity.

Carrying Handle — can be flipped to the back to support the meter at an easy-to-read angle.

Note: You need one 9-volt and one 1.5-volt AA battery (not included) to operate this multitester.

WARNING: USE EXTREME CAUTION IN THE USE OF THIS DEVICE. IMPROPER USE OF THIS DEVICE CAN RESULT IN INJURY OR DEATH. FOLLOW ALL SAFEGUARDS SUGGESTED IN THIS OWNER'S MANUAL IN ADDITION TO NORMAL SAFETY PRECAUTIONS IN DEALING WITH ELECTRICAL CIRCUITS. DO NOT USE THIS DEVICE IF YOU ARE UNFAMILIAR WITH ELECTRICAL CIRCUITS AND TESTING PROCEDURES.

NOT FOR COMMERCIAL OR INDUSTRIAL USE.

CONTENTS

A WORD ABOUT SAFETY

We have taken every precaution in designing and manufacturing this meter to ensure that it is as safe as we can make it. But safe operation depends on you, the operator. We recommend that you follow these simple safety rules:

- Use extreme caution when working with voltages above 30 Volts AC or 60 Volts DC. Always disconnect power from the circuit you are measuring before you connect the test probes to high-voltage points.
- Never connect the test probes to a source of voltage when you select resistance, continuity, or current measurement functions. Always turn off the meter's power and disconnect the test probes before you replace the batteries or fuse.
- Never operate the meter unless the back cover is in place and fully closed. Because some AC/DC sets have a hot chassis, be sure that the top of your work bench and the floor underneath it are made of non-conductive materials.
- The meter is fully calibrated and tested. Under normal use, no further adjustment should be necessary. If the meter should require repair, do not try to adjust it yourself. Take it to your local Radio Shack store. Service by unauthorized personnel voids the warranty.

SPECIFICATIONS

Ranges

DC Voltage	125 mV/250 mV/1.25V/2.5V/5V/10V/25V/50V/125V/250V/500V/1000V
AC Voltage	5V/10V/25V/50V/125V/250V/500V/1000V
DC Current	25 µA/50 µA/2.5 mA/5 mA/25 mA/50 mA/250 mA/500 mA/5 A/10 A
Resistance	2 kΩ/20 kΩ/2 MΩ/20 MΩ/(Center Scale 10)
Decibel	–20 dB to +62 dB in 8 Ranges

Accuracy

DC Voltage	±3% of full scale value except: ±4% of full scale value for 0.125 – 2.5 V, 500 V and 1000 V
AC Voltage	±4% of Full Scale Value
DC Current	±3% of Full Scale Value
Resistance	±3% of Full Scale Length
DC Sensitivity	50,000 Ω/V when Range Doubler Switch is in V/2•A/2 Position 25,000 Ω/V when Range Doubler Switch is in V-Ω-A Position
AC Sensitivity	10,000 Ω/V when Range Doubler Switch is in V/2•A/2 Position 5,000 Ω/V when Range Doubler Switch is in V-Ω-A Position

Meter Movement	4½-Inch, 3-Color, Mirrored Scale, 18 µA Full Scale
Buzzer Continuity	< 300 Ω (Approximate)
Batteries	One 1.5V AA Battery (Cat. No. 23-582 or 23-552) and One 9V Battery (Cat. No. 23-583 or 23-553)
Test Leads	Banana Plug Style
Dimensions	$6\frac{5}{8} \times 5\frac{3}{16} \times 1\frac{13}{16}$ Inches (168 × 132 × 46 mm)
Weight	12 Ounces (340 g)

CONTROLS AND FUNCTIONS

Scales — Three-color scale with mirror; green scale for ohms readings, red scale for ACV readings, and black scale for DCV, DCA, and dB readings.

Zero-Adjust Screw — Use to set the pointer exactly over the 0 at the left side of the AC/DC scale for ACV, DCV, DCA, and dB measurements.

Ohms-Adjust Control — Use to bring the pointer to 0 on the **OHMS** scale when measuring resistance in each **OHMS** range.

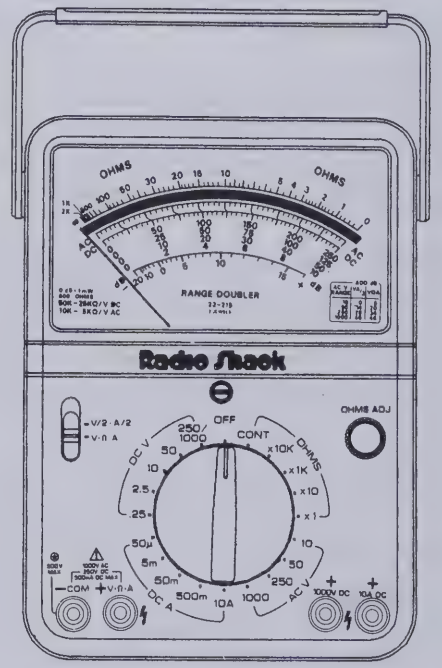
Range-Doubler Switch — Use to divide the range setting by two if the meter reading is not in the upper half of the scale during the initial measurement.

–COM Jack — Plug in the black test lead here for all measurements. Do not connect this jack to any source of more than 500 volts with respect to earth ground.

+V-Ω-A Jack — Plug in the red lead here for all measurements, except DC voltage measurements above 250 volts and DC current measurements above 500 mA. The maximum AC voltage measured here is 1000 VAC.

+1000V DC Jack — Plug in the red lead here when measuring DC voltage between 250 and 1000 volts.

+10A DC Jack — Plug in the red lead here only when measuring DC current of 500 mA to 10 A.



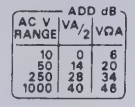
INCLUDED ACCESSORIES

Spare Fuse —Cat. No. 270-1271 - 250V, 0.5A. Stored inside the tester.

Banana Plug Styie Test Leads — Cat. No. 278-704.

SPECIAL PANEL MARKINGS

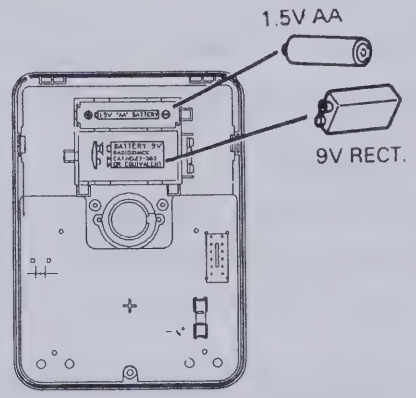
These special markings are added to the multitester's panel to remind you of important measurement limitations and safety precautions.

500V MAX ⏚	To avoid electrical shock and/or instrument damage, do not connect the common input terminal (– jack) to any source of more than 500 volts with respect to earth ground.
	Refer to the complete operating instructions.
1000V AC 250V DC 500mA DC MAX	The maximum voltage or current between these terminals is 1000 VAC, 250 VDC, and 500 mA DC.
	Be extra careful when making measurements for high voltage; do not touch terminals or test lead tips.
50K – 25KΩ / V DC 10K – 5KΩ / V AC	The multitester's inner resistance is 50 kΩ (DC) or 10 kΩ (AC) per volt with the range doubler switch set to V/2•A/2; 25 kΩ (DC) or 5 kΩ (AC) per volt with the range doubler switch in the V-Ω-A position.
0 dB = 1 mW 600 OHMS	0 dB means that 1 milliwatt is dissipated in a 600Ω impedance device.
	Add the appropriate number in this chart to the dB scale reading.

PREPARATION

INSTALLING/REPLACING THE BATTERIES

You need to install one 9V battery (Cat. No. 23-583 or 23-553) for the 20 MΩ (**x 10k**) and the continuity range, and one 1.5V AA battery (Cat. No. 23-582 or 23-552) for other resistance measurements. Follow these steps to install fresh batteries.



1. Disconnect the test leads from the circuit you are measuring.
2. Set the range switch to **OFF**.
3. Open the cabinet by removing the screw from the back, and remove the old batteries, if necessary.
4. Install the batteries as indicated by the polarity symbols (+ and –) in the battery compartment diagram.
5. Close the cabinet and replace the screw.

Replace the batteries if:

- You cannot bring the pointer to 0 on the **OHMS** scale on each range of the Ohms function by touching the test lead tips together.
- The buzzer does not sound on the **CONT** range when you touch the test lead tips together.

Cautions:

- Never leave weak or dead batteries in your tester. Even leak-proof batteries can leak damaging chemicals.
- Remove the batteries if you do not plan to use the tester for a week or more.

REPLACING THE FUSE

The tester uses an internal fuse to prevent an accidental voltage overload. The fuse blows if voltage is applied when the tester is in the **OHMS** or current range (except the 10A range), or when excess voltage is applied in the 0.25 DCV/0.125 DCV range. When the fuse blows, the meter stops working.

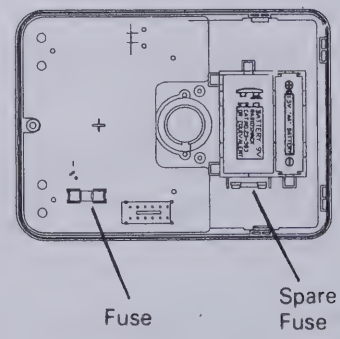
Warning: To avoid electric shock, disconnect the test leads from the circuit under test before removing the fuse.

Caution: For continued protection, replace with a fuse of the same type and rating. We recommend a 0.5A/250V fuse such as Cat. No. 270-1271.

To replace the fuse:

1. Disconnect the test leads from the circuit under test.
2. Set the range switch to **OFF**.
3. Open the tester cabinet by removing the screw from the back.

   There are two fuses in the tester. The circuit fuse is in the metal fuse holder on a board with a red ribbon ring around it. Check this fuse when the tester stops working.
4. Remove the blown fuse by pulling the red ribbon ring.
5. Place the ribbon on the replacement fuse.
6. Insert the replacement fuse into the metal fuse holder.
7. Close the tester cabinet and replace the screw.



OPERATION

METER READING

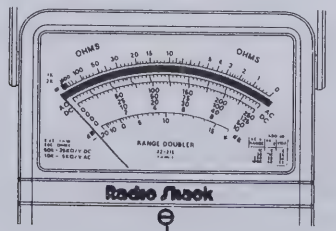
- Keep the tester on a flat, non-metallic surface for the most accurate readings.
- Select a setting that gives a reading in the upper ⅓ or ½ of the meter scale.
- When you read the scale, look at it from the point where the pointer and its reflection in the mirror come together.
- Read from the scale that matches the color of the function you select – green for **OHMS**, red for **ACV**, and black for **DCV/DCA** and decibels.

To read the AC/DC scale, use the appropriate markings based on the selected range.

Marking	Selected Range
0 to 250	0.25, 2.5, 25, 250
0 to 125	0.125, 1.25, 125
0 to 50	5, 50, 500
0 to 10	10, 1000

ZERO ADJUSTMENT

If the pointer does not normally rest exactly over the zero at the left side of the **AC/DC** scale, adjust the plastic screw in the center of the tester face to bring the pointer to zero.



Zero Ajust Screw

OHMS ADJUSTMENT

When measuring resistance on each **OHMS** range, you must bring the pointer to 0 at the right side of the upper green **OHMS** scale.

To do this, connect the black test lead to the **–COM** jack and the red test lead to the **+V-Ω-A** jack. Set the range switch to one of the OHMS positions. Then touch the test lead tips together, and adjust **OHMS ADJ** to bring the pointer to 0 on the right side of the **OHMS** scale.

Notes:

- You must do this adjustment whenever you change the **OHMS** range.
- If you cannot adjust the pointer to 0 on the **OHMS** scale when the range switch is set to the **x1**, **x10**, or the **x1K** position, replace the 1.5V AA battery.
- If you cannot adjust the pointer to 0 on the **OHMS** scale when the range switch is set to the **x10K** position, replace the 9V battery.

RANGE-DOUBLER SWITCH

If the reading is in the lower half of the scale when you measure ACV, DCV, DCA, or dB, set the range doubler switch to the **V/2•A/2** position to divide the range setting by two. This gives you more accurate readings.

When you use the **V/2•A/2** setting, divide the range switch setting by two and read the appropriate scale.

Examples:

- The range switch is set to **250 AC V** and the range doubler switch is set to **V/2•A/2**: The range is 125 volts (250 divided by 2) and you should read the red scale, following the 0 to 125 markings.
- The range switch is set to **10A** and the range doubler switch is set to the **V/2•A/2** (the black test lead is connected to the **–COM** jack and the red test lead to the **+10A DC** jack). The range is 5A (10 divided by 2), and you should read the black scale, following the 0 to 50 markings.

USING THE TEST LEADS

Use only the same type of test leads supplied with your tester. These test leads are rated for 1200 volts. Replacement test leads (Cat. No. 278-704) are available at your local Radio Shack store.

Caution: Although these test leads are rated for 1200 volts, the maximum rating of the tester is 1000 VAC/DC. Do not attempt to measure any voltage greater than 1000 VAC/DC.

Always observe correct test lead polarity when making DC measurements. The black lead should always be connected to the **–COM** jack. If you connect using the wrong polarity, the tester's pointer swings to the left and goes out of range. Connect the red lead to the **+V-Ω-A** jack for making DC voltage measurements up to 250 V, DC current up to 500 mA, all AC voltages (up to 1000 VAC), and all resistance measurements.

Connect the red lead to the **+1000V DC** jack when measuring DC voltages from 250-1000 V. Connect the red lead to the **+10A DC** jack when measuring DC current from 500 mA to 10 A.

Warning: Never allow your fingers to touch the bare metal portion of the test leads (or circuit points) during measurements.

Caution: Always disconnect the test leads when you have finished using the tester.

DC VOLTAGE MEASUREMENTS

Warning: Use extreme care when making high-voltage measurements. Do not touch the terminal or test lead tips.

1. Plug the black test lead into the **-COM** jack.
2. Plug the red test lead into the **+V-Ω-A** jack if the voltage to be measured is under 250V. For voltages between 250-1000V, plug the red test lead into the **+1000V DC** jack.

   If you do not know the voltage level, plug the red test lead into the **+1000V DC** jack and start with the **250/1000V** range. If the meter reading is in the lower half of the scale, plug the red test lead into the **V-Ω-A** jack and lower the range using the range and range doubler switches until the reading is in the upper ½ or ⅓ of the scale.

   Note: Use the **+1000V DC** jack only with DC voltages of 250 to 1000V.
3. Set the range switch to one of the **DCV** positions.

   Caution: When excess voltage is applied to the **0.25 DCV** or **0.125 DCV** range, the fuse in the tester will blow, and the tester does not work until you replace the fuse.
4. Connect the test lead tips to the circuit to be tested, with the red lead to the positive supply and the black lead to the negative supply.
5. Set the range and the range doubler switches to get a meter reading in the upper ½ or ⅓ of the scale.
6. Read the voltage on the black **DC** scale.

If the range doubler switch is set to **V/2•A/2**, divide the range switch setting by two and read the appropriate scale.

AC VOLTAGE MEASUREMENTS

Warning: Use extreme care when making high-voltage measurements. Do not touch the terminal or test lead tips.

1. Plug the black test lead into the **–COM** jack and the red lead into the **+V-Ω-A** jack.
2. Set the range switch to one of the **ACV** positions. If you are uncertain about the level of the voltage to be measured, it is best to start at the highest range (**1000V**) and work down the scale.
3. Connect the test lead tips to the circuit to be tested.
4. Set the range and the range doubler switches as required to get a meter reading in the upper ½ or ⅓ of the scale.
5. Read the voltage on the red **AC** scale, following the black numbers printed below the red scale.

If the range doubler switch is set to the **V/2•A/2** position, divide the range switch setting by two and read the appropriate scale.

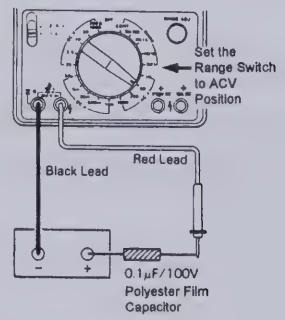
HIGH-VOLTAGE MEASUREMENTS

When you use the tester to probe for a voltage in a high-voltage circuit, we recommend that you do not try to position both of the test leads at once. Instead, clamp one lead to the neutral or ground lead of the circuit, using Radio Shack insulated slip-on alligator clips (Cat. No. 270-354). Then probe for voltages with the other probe and put your free hand in your pocket. This helps prevent you from accidentally touching a hot wire, since you need only concentrate on one test lead.

Warning: Never clamp to a hot wire. If you do and then touch the other probe connected to the tester, you could receive an electric shock.

AC VOLTAGE RIDING ON A DC SOURCE BIAS MEASUREMENTS

When measuring an AC voltage superimposed on a DC voltage source bias, you cannot make ordinary measurements. In this situation, if you know the approximate voltage of the device to be measured and the voltage is under 30V AC on a DC source bias, you can measure the voltage by connecting a 0.1 µf/100 V polyester film capacitor in series with the positive terminal of the voltage source and the red test lead. Set the range switch to either the 10 or 50 **ACV** position.



Warning: Do not make this type of measurement if the AC voltage is greater than 100V with respect to earth ground.

MEASURING 3-PHASE AC VOLTAGES

We designed your meter to measure household AC voltage. It is not intended for commercial or industrial use. Please note the following regarding 3-phase AC voltages.

Warnings:

- Because of the dangers inherent in measuring 3-phase circuits, do not use this meter for such applications. The actual voltage can be greater than the circuit's rated line-to-ground voltage.
- To determine the line-to-line voltage, multiply the rated line-to-ground voltage by 1.732 (the square root of 3).

  For example, if the rated line-to-ground voltage is 640 volts, the line-to-line voltage is:

  $640 \times 1.732 = 1108$ Volts

  This voltage exceeds the meter's rating and you should not connect the meter to this circuit.

RESISTANCE MEASUREMENTS

Warning: Do not apply voltage to the test leads when the range switch is in an **OHMS** position. Doing so causes the fuse to blow, and the tester stops working.

Before taking any resistance measurements, disconnect power to the unit under test and discharge any capacitors. It is best to remove any batteries from the unit under test and unplug any line cords.

To make resistance measurements:

1. Plug the black test lead into the **–COM** jack and the red test lead into the **+V-Ω-A** jack.
2. Leave the range doubler switch in the **V-Ω-A** position.
3. Set the range switch to one of the **OHMS** positions.
4. Touch the test lead tips together and adjust **OHMS ADJ** to bring the pointer to 0 at the right side of the green **OHMS** scale.

   Note: You must adjust the pointer to 0 each time you change ranges in the **OHMS** function (except the **CONT** position). If you cannot adjust the pointer to 0, replace the battery. See "Installing/Replacing the Batteries."
5. Connect the test lead tips across the circuit or part under test.

   Note: When measuring a part's resistance, disconnect one side of the component under test so the remainder of the circuit does not interfere with the readings.
6. Read the resistance on the green **OHMS** scale.
7. Use the appropriate multiplier to find the correct resistance value. Multiply the value that the pointer indicates in the scale by 1, 10, 1000, or 10,000 depending on the range switch's position.

When trying to identify the cathode and anode ends or the type of transistor (PNP or NPN), the actual poliarity of the tester's voltage is the opposite of the test lead colors. The red test lead is the negative source and the black test lead is positive.

CONTINUITY CHECK

Follow these steps to check for continuity in a wire or circuit.

1. Plug the black test lead into the **–COM** jack and the red test lead into the **+V-Ω-A** jack.
2. Set the range switch to **CONT** on the **OHMS** range.
3. Touch the test lead tips together to check the built-in buzzer.
   If the buzzer does not sound, replace the 9V battery.
4. Connect the test leads to the unit under test.

If the resistance is between 0 and 300Ω, the built-in buzzer sounds.

Note: The buzzer's sound level decreases as the resistance increases.

DC CURRENT MEASUREMENTS

To measure current, you must break the circuit and connect the test leads in series with the circuit.

Warning: Do not apply voltage to the test leads when the range switch is set to a **DCA** position. Doing so blows the fuse, and the meter stops working.

Note: The 10A range is not fuse protected.

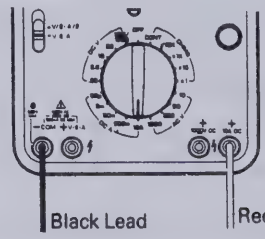
1. Set the range switch to one of the **DCA** positions.

   If you do not know the current level to be measured, start at the highest **10A** range, then lower the range using the range doubler and range switches.

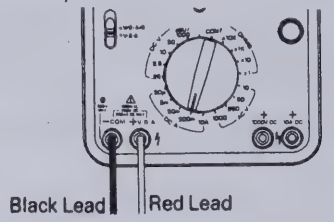
2. Connect the red test lead to:
   - **+10A DC** to measure current over 500 mA and under 10 A.
   - **+V-Ω-A** to measure current of 500 mA or less.
3. Connect the black test lead to the **–COM** jack.
4. Remove power from the circuit under test and break the circuit at the appropriate point.
5. Connect the test leads in series with the circuit (black lead to the negative side and red lead to the positive side).
6. Apply power to the circuit under test.
7. Set the range doubler and range switches as required to get a reading in the upper ½ or ⅓ of the scale.
8. Read the current on the black **DC** scale.

   Note: If you set the range doubler switch to **V/2•A/2**, divide the range switch setting by two and read the scale.

10A Range



50 µA/5 mA/50 mA/500 mA Range



DECIBEL MEASUREMENTS

1. Plug the black test lead into the **–COM** jack and the red test lead into the **+V-Ω-A** jack.
2. Set the range switch to one of the **ACV** positions.
3. Connect the test lead tips to the circuit under test.
4. Set the range doubler switch as required to get a reading in the upper ½ or ⅓ of the scale.
5. Read the lower black **dB** scale, adding the appropriate number of decibels to the **dB** scale as noted on the chart at the lower right of the scale. For example, if the pointer indicates +12 dB and the range switch is set to **50 AC V** and the range doubler switch is set to **V/2•A/2**, add 14 decibels to the indicated value. The result is +26 dB.

   Note: For the most accurate decibel readings, the circuit impedance must be 600Ω.

CARE AND MAINTENANCE

Your Radio Shack Range Doubler Multitester is an example of superior design and craftsmanship. The following suggestions will help you care for the meter so you can enjoy it for years.

Keep the meter dry. If it gets wet, immediately wipe it dry. Liquids can contain minerals that can corrode the electronic circuits.

Use and store the meter only in normal temperature environments. Temperature extremes can shorten the life of electronic devices, damage batteries, and distort or melt plastic parts.

Handle the meter gently and carefully. Dropping it can damage the circuit boards and cause the meter to work improperly.

Wipe the meter with a damp cloth occasionally to keep it looking new. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the meter.

Use only fresh batteries of the recommended size and type. Always remove old or weak batteries. They can leak chemicals that destroy electronic circuits.

Keep the meter away from dust and dirt, which can cause parts to wear prematurely.

Modifying or tampering with your meter's internal components can cause a malfunction and might invalidate the meter's warranty. If your meter is not performing as it should, take it to your local Radio Shack store for assistance.

RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 90 days from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

EXCEPT AS PROVIDED HEREIN, RADIO SHACK MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Some states do not permit limitation or exclusion of implied warranties; therefore, the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state

We Service What We Sell

RADIO SHACK
A Division of Tandy Corporation
Fort Worth, Texas 76102

2A5

811024260**D**
Printed in Hong Kong

NOTES

RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 90 days from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

EXCEPT AS PROVIDED HEREIN, RADIO SHACK MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Some states do not permit limitation or exclusion of implied warranties; therefore, the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state

We Service What We Sell

RADIO SHACK
A Division of Tandy Corporation
Fort Worth, Texas 76102

2A5

811024260**D**
Printed in Hong Kong

DECIBEL MEASUREMENTS

1. Plug the black test lead into the **–COM** jack and the red test lead into the **+V-Ω-A** jack.
2. Set the range switch to one of the **ACV** positions.
3. Connect the test lead tips to the circuit under test.
4. Set the range doubler switch as required to get a reading in the upper ½ or ⅓ of the scale.
5. Read the lower black **dB** scale, adding the appropriate number of decibels to the **dB** scale as noted on the chart at the lower right of the scale. For example, if the pointer indicates +12 dB and the range switch is set to **50 AC V** and the range doubler switch is set to **V/2•A/2**, add 14 decibels to the indicated value. The result is +26 dB.

   Note: For the most accurate decibel readings, the circuit impedance must be 600Ω.

CARE AND MAINTENANCE

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Use and store the meter only in normal temperature environments. Temperature extremes can shorten the life of electronic devices, damage batteries, and distort or melt plastic parts.

Handle the meter gently and carefully. Dropping it can damage the circuit boards and cause the meter to work improperly.

Wipe the meter with a damp cloth occasionally to keep it looking new. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the meter.

Use only fresh batteries of the recommended size and type. Always remove old or weak batteries. They can leak chemicals that destroy electronic circuits.

Keep the meter away from dust and dirt, which can cause parts to wear prematurely.

Modifying or tampering with your meter's internal components can cause a malfunction and might invalidate the meter's warranty. If your meter is not performing as it should, take it to your local Radio Shack store for assistance.

CONTINUITY CHECK

Follow these steps to check for continuity in a wire or circuit.

1. Plug the black test lead into the **–COM** jack and the red test lead into the **+V-Ω-A** jack.
2. Set the range switch to **CONT** on the **OHMS** range.
3. Touch the test lead tips together to check the built-in buzzer.
   If the buzzer does not sound, replace the 9V battery.
4. Connect the test leads to the unit under test.

If the resistance is between 0 and 300Ω, the built-in buzzer sounds.

Note: The buzzer's sound level decreases as the resistance increases.

DC CURRENT MEASUREMENTS

To measure current, you must break the circuit and connect the test leads in series with the circuit.

Warning: Do not apply voltage to the test leads when the range switch is set to a **DCA** position. Doing so blows the fuse, and the meter stops working.

Note: The 10A range is not fuse protected.

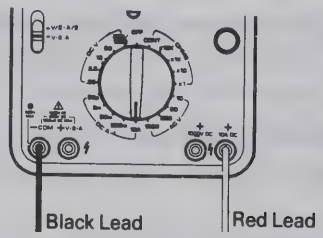
1. Set the range switch to one of the **DCA** positions.

   If you do not know the current level to be measured, start at the highest **10A** range, then lower the range using the range doubler and range switches.

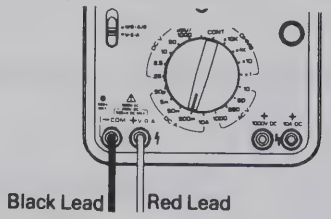
2. Connect the red test lead to:
   - **+10A DC** to measure current over 500 mA and under 10 A.
   - **+V-Ω-A** to measure current of 500 mA or less.
3. Connect the black test lead to the **–COM** jack.
4. Remove power from the circuit under test and break the circuit at the appropriate point.
5. Connect the test leads in series with the circuit (black lead to the negative side and red lead to the positive side).
6. Apply power to the circuit under test.
7. Set the range doubler and range switches as required to get a reading in the upper ½ or ⅓ of the scale.
8. Read the current on the black **DC** scale.

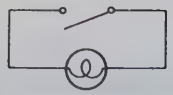
   Note: If you set the range doubler switch to **V/2•A/2**, divide the range switch setting by two and read the scale.

10A Range



50 µA/5 mA/50 mA/500 mA Range





MEASURING 3-PHASE AC VOLTAGES

We designed your meter to measure household AC voltage. It is not intended for commercial or industrial use. Please note the following regarding 3-phase AC voltages.

Warnings:

- Because of the dangers inherent in measuring 3-phase circuits, do not use this meter for such applications. The actual voltage can be greater than the circuit's rated line-to-ground voltage.
- To determine the line-to-line voltage, multiply the rated line-to-ground voltage by 1.732 (the square root of 3).

  For example, if the rated line-to-ground voltage is 640 volts, the line-to-line voltage is:

  $640 \times 1.732 = 1108$ Volts

  This voltage exceeds the meter's rating and you should not connect the meter to this circuit.

RESISTANCE MEASUREMENTS

Warning: Do not apply voltage to the test leads when the range switch is in an **OHMS** position. Doing so causes the fuse to blow, and the tester stops working.

Before taking any resistance measurements, disconnect power to the unit under test and discharge any capacitors. It is best to remove any batteries from the unit under test and unplug any line cords.

To make resistance measurements:

1. Plug the black test lead into the **–COM** jack and the red test lead into the **+V-Ω-A** jack.
2. Leave the range doubler switch in the **V-Ω-A** position.
3. Set the range switch to one of the **OHMS** positions.
4. Touch the test lead tips together and adjust **OHMS ADJ** to bring the pointer to 0 at the right side of the green **OHMS** scale.

   Note: You must adjust the pointer to 0 each time you change ranges in the **OHMS** function (except the **CONT** position). If you cannot adjust the pointer to 0, replace the battery. See "Installing/Replacing the Batteries."
5. Connect the test lead tips across the circuit or part under test.

   Note: When measuring a part's resistance, disconnect one side of the component under test so the remainder of the circuit does not interfere with the readings.
6. Read the resistance on the green **OHMS** scale.
7. Use the appropriate multiplier to find the correct resistance value. Multiply the value that the pointer indicates in the scale by 1, 10, 1000, or 10,000 depending on the range switch's position.

When trying to identify the cathode and anode ends or the type of transistor (PNP or NPN), the actual poliarity of the tester's voltage is the opposite of the test lead colors. The red test lead is the negative source and the black test lead is positive.

AC VOLTAGE MEASUREMENTS

Warning: Use extreme care when making high-voltage measurements. Do not touch the terminal or test lead tips.

1. Plug the black test lead into the **–COM** jack and the red lead into the **+V-Ω-A** jack.
2. Set the range switch to one of the **ACV** positions. If you are uncertain about the level of the voltage to be measured, it is best to start at the highest range (**1000V**) and work down the scale.
3. Connect the test lead tips to the circuit to be tested.
4. Set the range and the range doubler switches as required to get a meter reading in the upper ½ or ⅓ of the scale.
5. Read the voltage on the red **AC** scale, following the black numbers printed below the red scale.

If the range doubler switch is set to the **V/2•A/2** position, divide the range switch setting by two and read the appropriate scale.

HIGH-VOLTAGE MEASUREMENTS

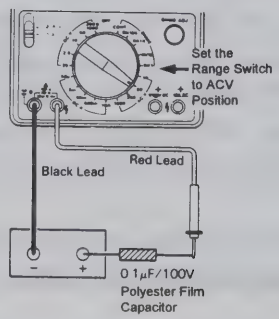
When you use the tester to probe for a voltage in a high-voltage circuit, we recommend that you do not try to position both of the test leads at once. Instead, clamp one lead to the neutral or ground lead of the circuit, using Radio Shack insulated slip-on alligator clips (Cat. No. 270-354). Then probe for voltages with the other probe and put your free hand in your pocket. This helps prevent you from accidentally touching a hot wire, since you need only concentrate on one test lead.

Warning: Never clamp to a hot wire. If you do and then touch the other probe connected to the tester, you could receive an electric shock.

AC VOLTAGE RIDING ON A DC SOURCE BIAS MEASUREMENTS

When measuring an AC voltage superimposed on a DC voltage source bias, you cannot make ordinary measurements. In this situation, if you know the approximate voltage of the device to be measured and the voltage is under 30V AC on a DC source bias, you can measure the voltage by connecting a 0.1 µf/100 V polyester film capacitor in series with the positive terminal of the voltage source and the red test lead. Set the range switch to either the 10 or 50 **ACV** position.

Warning: Do not make this type of measurement if the AC voltage is greater than 100V with respect to earth ground.



USING THE TEST LEADS

Use only the same type of test leads supplied with your tester. These test leads are rated for 1200 volts. Replacement test leads (Cat. No. 278-704) are available at your local Radio Shack store.

Caution: Although these test leads are rated for 1200 volts, the maximum rating of the tester is 1000 VAC/DC. Do not attempt to measure any voltage greater than 1000 VAC/DC.

Always observe correct test lead polarity when making DC measurements. The black lead should always be connected to the **–COM** jack. If you connect using the wrong polarity, the tester's pointer swings to the left and goes out of range. Connect the red lead to the **+V-Ω-A** jack for making DC voltage measurements up to 250 V, DC current up to 500 mA, all AC voltages (up to 1000 VAC), and all resistance measurements.

Connect the red lead to the **+1000V DC** jack when measuring DC voltages from 250-1000 V. Connect the red lead to the **+10A DC** jack when measuring DC current from 500 mA to 10 A.

Warning: Never allow your fingers to touch the bare metal portion of the test leads (or circuit points) during measurements.

Caution: Always disconnect the test leads when you have finished using the tester.

DC VOLTAGE MEASUREMENTS

Warning: Use extreme care when making high-voltage measurements. Do not touch the terminal or test lead tips.

1. Plug the black test lead into the **–COM** jack.
2. Plug the red test lead into the **+V-Ω-A** jack if the voltage to be measured is under 250V. For voltages between 250-1000V, plug the red test lead into the **+1000V DC** jack.

   If you do not know the voltage level, plug the red test lead into the **+1000V DC** jack and start with the **250/1000V** range. If the meter reading is in the lower half of the scale, plug the red test lead into the **V-Ω-A** jack and lower the range using the range and range doubler switches until the reading is in the upper ½ or ⅓ of the scale.

   Note: Use the **+1000V DC** jack only with DC voltages of 250 to 1000V.
3. Set the range switch to one of the **DCV** positions.

   Caution: When excess voltage is applied to the **0.25 DCV** or **0.125 DCV** range, the fuse in the tester will blow, and the tester does not work until you replace the fuse.
4. Connect the test lead tips to the circuit to be tested, with the red lead to the positive supply and the black lead to the negative supply.
5. Set the range and the range doubler switches to get a meter reading in the upper ½ or ⅓ of the scale.
6. Read the voltage on the black **DC** scale.

If the range doubler switch is set to **V/2•A/2**, divide the range switch setting by two and read the appropriate scale.

METER READING

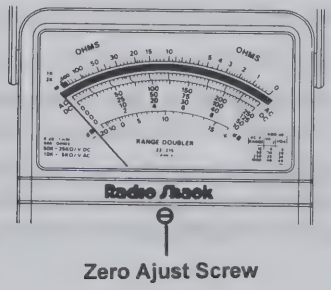
- Keep the tester on a flat, non-metallic surface for the most accurate readings.
- Select a setting that gives a reading in the upper ⅓ or ½ of the meter scale.
- When you read the scale, look at it from the point where the pointer and its reflection in the mirror come together.
- Read from the scale that matches the color of the function you select – green for **OHMS**, red for **ACV**, and black for **DCV/DCA** and decibels.

To read the AC/DC scale, use the appropriate markings based on the selected range.

Marking	Selected Range
0 to 250	0.25, 2.5, 25, 250
0 to 125	0.125, 1.25, 125
0 to 50	5, 50, 500
0 to 10	10, 1000

ZERO ADJUSTMENT

If the pointer does not normally rest exactly over the zero at the left side of the **AC/DC** scale, adjust the plastic screw in the center of the tester face to bring the pointer to zero.



OHMS ADJUSTMENT

When measuring resistance on each **OHMS** range, you must bring the pointer to 0 at the right side of the upper green **OHMS** scale.

To do this, connect the black test lead to the **–COM** jack and the red test lead to the **+V-Ω-A** jack. Set the range switch to one of the OHMS positions. Then touch the test lead tips together, and adjust **OHMS ADJ** to bring the pointer to 0 on the right side of the **OHMS** scale.

Notes:

- You must do this adjustment whenever you change the **OHMS** range.
- If you cannot adjust the pointer to 0 on the **OHMS** scale when the range switch is set to the **x1**, **x10**, or the **x1K** position, replace the 1.5V AA battery.
- If you cannot adjust the pointer to 0 on the **OHMS** scale when the range switch is set to the **x10K** position, replace the 9V battery.

RANGE-DOUBLER SWITCH

If the reading is in the lower half of the scale when you measure ACV, DCV, DCA, or dB, set the range doubler switch to the **V/2•A/2** position to divide the range setting by two. This gives you more accurate readings.

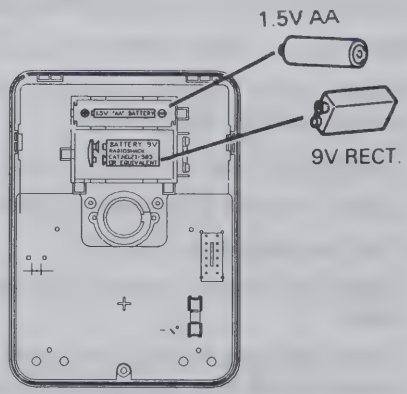
When you use the **V/2•A/2** setting, divide the range switch setting by two and read the appropriate scale.

Examples:

- The range switch is set to **250 AC V** and the range doubler switch is set to **V/2•A/2**: The range is 125 volts (250 divided by 2) and you should read the red scale, following the 0 to 125 markings.
- The range switch is set to **10A** and the range doubler switch is set to the **V/2•A/2** (the black test lead is connected to the **–COM** jack and the red test lead to the **+10A DC** jack). The range is 5A (10 divided by 2), and you should read the black scale, following the 0 to 50 markings.

INSTALLING/REPLACING THE BATTERIES

You need to install one 9V battery (Cat. No. 23-583 or 23-553) for the 20 MΩ (**x 10k**) and the continuity range, and one 1.5V AA battery (Cat. No. 23-582 or 23-552) for other resistance measurements. Follow these steps to install fresh batteries.



1. Disconnect the test leads from the circuit you are measuring.
2. Set the range switch to **OFF**.
3. Open the cabinet by removing the screw from the back, and remove the old batteries, if necessary.
4. Install the batteries as indicated by the polarity symbols (+ and –) in the battery compartment diagram.
5. Close the cabinet and replace the screw.

Replace the batteries if:

- You cannot bring the pointer to 0 on the **OHMS** scale on each range of the Ohms function by touching the test lead tips together.
- The buzzer does not sound on the **CONT** range when you touch the test lead tips together.

Cautions:

- Never leave weak or dead batteries in your tester. Even leak-proof batteries can leak damaging chemicals.
- Remove the batteries if you do not plan to use the tester for a week or more.

REPLACING THE FUSE

The tester uses an internal fuse to prevent an accidental voltage overload. The fuse blows if voltage is applied when the tester is in the **OHMS** or current range (except the 10A range), or when excess voltage is applied in the 0.25 DCV/0.125 DCV range. When the fuse blows, the meter stops working.

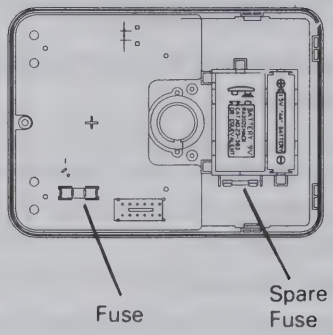
Warning: To avoid electric shock, disconnect the test leads from the circuit under test before removing the fuse.

Caution: For continued protection, replace with a fuse of the same type and rating. We recommend a 0.5A/250V fuse such as Cat. No. 270-1271.

To replace the fuse:

1. Disconnect the test leads from the circuit under test.
2. Set the range switch to **OFF**.
3. Open the tester cabinet by removing the screw from the back.

   There are two fuses in the tester. The circuit fuse is in the metal fuse holder on a board with a red ribbon ring around it. Check this fuse when the tester stops working.
4. Remove the blown fuse by pulling the red ribbon ring.
5. Place the ribbon on the replacement fuse.
6. Insert the replacement fuse into the metal fuse holder.
7. Close the tester cabinet and replace the screw.



INCLUDED ACCESSORIES

Spare Fuse —Cat. No. 270-1271 - 250V, 0.5A. Stored inside the tester.

Banana Plug Style Test Leads — Cat. No. 278-704.

SPECIAL PANEL MARKINGS

These special markings are added to the multitester's panel to remind you of important measurement limitations and safety precautions.

500V MAX ⏚	To avoid electrical shock and/or instrument damage, do not connect the common input terminal (– jack) to any source of more than 500 volts with respect to earth ground.
	Refer to the complete operating instructions.
1000V AC 250V DC 500mA DC MAX	The maximum voltage or current between these terminals is 1000 VAC, 250 VDC, and 500 mA DC.
	Be extra careful when making measurements for high voltage; do not touch terminals or test lead tips.
50K–25KΩ/V DC 10K– 5KΩ/V AC	The multitester's inner resistance is 50 kΩ (DC) or 10 kΩ (AC) per volt with the range doubler switch set to V/2•A/2; 25 kΩ (DC) or 5 kΩ (AC) per volt with the range doubler switch in the V-Ω-A position.
0 dB = 1 mW 600 OHMS	0 dB means that 1 milliwatt is dissipated in a 600Ω impedance device.
ADD dB AC V RANGE / VA/2 / VΩA 10 / 0 / 6 50 / 14 / 20 250 / 28 / 34 1000 / 40 / 46	Add the appropriate number in this chart to the dB scale reading.

SPECIFICATIONS

Ranges

DC Voltage	125 mV/250 mV/1.25V/2.5V/5V/10V/25V/50V/125V/250V/500V/1000V
AC Voltage	5V/10V/25V/50V/125V/250V/500V/1000V
DC Current	25 µA/50 µA/2.5 mA/5 mA/25 mA/50 mA/250 mA/500 mA/5 A/10 A
Resistance	2 kΩ/20 kΩ/2 MΩ/20 MΩ/(Center Scale 10)
Decibel	–20 dB to +62 dB in 8 Ranges

Accuracy

DC Voltage	±3% of full scale value except: ±4% of full scale value for 0.125 – 2.5 V, 500 V and 1000 V
AC Voltage	±4% of Full Scale Value
DC Current	±3% of Full Scale Value
Resistance	±3% of Full Scale Length
DC Sensitivity	50,000 Ω/V when Range Doubler Switch is in V/2•A/2 Position 25,000 Ω/V when Range Doubler Switch is in V-Ω-A Position
AC Sensitivity	10,000 Ω/V when Range Doubler Switch is in V/2•A/2 Position 5,000 Ω/V when Range Doubler Switch is in V-Ω-A Position

Meter Movement	4½-Inch, 3-Color, Mirrored Scale, 18 µA Full Scale
Buzzer Continuity	< 300 Ω (Approximate)
Batteries	One 1.5V AA Battery (Cat. No. 23-582 or 23-552) and One 9V Battery (Cat. No. 23-583 or 23-553)
Test Leads	Banana Plug Style
Dimensions	$6\frac{5}{8} \times 5\frac{3}{16} \times 1\frac{13}{16}$ Inches (168 × 132 × 46 mm)
Weight	12 Ounces (340 g)

CONTROLS AND FUNCTIONS

Scales — Three-color scale with mirror; green scale for ohms readings, red scale for ACV readings, and black scale for DCV, DCA, and dB readings.

Zero-Adjust Screw — Use to set the pointer exactly over the 0 at the left side of the AC/DC scale for ACV, DCV, DCA, and dB measurements.

Ohms-Adjust Control — Use to bring the pointer to 0 on the **OHMS** scale when measuring resistance in each **OHMS** range.

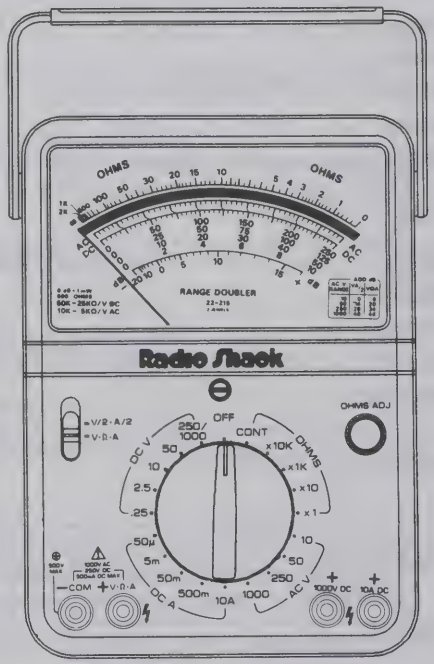
Range-Doubler Switch — Use to divide the range setting by two if the meter reading is not in the upper half of the scale during the initial measurement.

–COM Jack — Plug in the black test lead here for all measurements. Do not connect this jack to any source of more than 500 volts with respect to earth ground.

+V-Ω-A Jack — Plug in the red lead here for all measurements, except DC voltage measurements above 250 volts and DC current measurements above 500 mA. The maximum AC voltage measured here is 1000 VAC.

+1000V DC Jack — Plug in the red lead here when measuring DC voltage between 250 and 1000 volts.

+10A DC Jack — Plug in the red lead here only when measuring DC current of 500 mA to 10 A.



CONTENTS

A WORD ABOUT SAFETY

We have taken every precaution in designing and manufacturing this meter to ensure that it is as safe as we can make it. But safe operation depends on you, the operator. We recommend that you follow these simple safety rules:

- Use extreme caution when working with voltages above 30 Volts AC or 60 Volts DC. Always disconnect power from the circuit you are measuring before you connect the test probes to high-voltage points.
- Never connect the test probes to a source of voltage when you select resistance, continuity, or current measurement functions. Always turn off the meter's power and disconnect the test probes before you replace the batteries or fuse.
- Never operate the meter unless the back cover is in place and fully closed. Because some AC/DC sets have a hot chassis, be sure that the top of your work bench and the floor underneath it are made of non-conductive materials.
- The meter is fully calibrated and tested. Under normal use, no further adjustment should be necessary. If the meter should require repair, do not try to adjust it yourself. Take it to your local Radio Shack store. Service by unauthorized personnel voids the warranty.

Cat. No. 22-215

OWNER'S MANUAL

Please read before using this equipment.

Range Doubler Multitester

Radio Shack®

FEATURES

Your Radio Shack Range Doubler Multitester is a high-sensitivity analog multitester, ideally suited for field, lab, shop, and home applications. These features make the multitester easy to use and ensure accurate and reliable operation.

Range Doubler Switch — effectively doubles the number of available AC and DC scales for greater accuracy.

Low DC Ranges — 125 mV and 25 µA — great for solid state work.

Sensitive 18 µA Meter Movement with 4½-Inch Face and Mirrored Scale — simplifies accurate reading.

Built-In Diodes and Fuse — protect meter movement and other internal parts in case of improper function selection.

Audible Continuity Function — built-in buzzer sounds when there is continuity.

Carrying Handle — can be flipped to the back to support the meter at an easy-to-read angle.

Note: You need one 9-volt and one 1.5-volt AA battery (not included) to operate this multitester.

WARNING: USE EXTREME CAUTION IN THE USE OF THIS DEVICE. IMPROPER USE OF THIS DEVICE CAN RESULT IN INJURY OR DEATH. FOLLOW ALL SAFEGUARDS SUGGESTED IN THIS OWNER'S MANUAL IN ADDITION TO NORMAL SAFETY PRECAUTIONS IN DEALING WITH ELECTRICAL CIRCUITS. DO NOT USE THIS DEVICE IF YOU ARE UNFAMILIAR WITH ELECTRICAL CIRCUITS AND TESTING PROCEDURES.

NOT FOR COMMERCIAL OR INDUSTRIAL USE.

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- Never connect the test probes to a source of voltage when you select resistance, continuity, or current measurement functions. Always turn off the meter's power and disconnect the test probes before you replace the batteries or fuse.
- Never operate the meter unless the back cover is in place and fully closed. Because some AC/DC sets have a hot chassis, be sure that the top of your work bench and the floor underneath it are made of non-conductive materials.
- The meter is fully calibrated and tested. Under normal use, no further adjustment should be necessary. If the meter should require repair, do not try to adjust it yourself. Take it to your local Radio Shack store. Service by unauthorized personnel voids the warranty.

SPECIFICATIONS

Ranges

DC Voltage	125 mV/250 mV/1.25V/2.5V/5V/10V/25V/50V/125V/250V/500V/1000V
AC Voltage	5V/10V/25V/50V/125V/250V/500V/1000V
DC Current	25 µA/50 µA/2.5 mA/5 mA/25 mA/50 mA/250 mA/500 mA/5 A/10 A
Resistance	2 kΩ/20 kΩ/2 MΩ/20 MΩ/(Center Scale 10)
Decibel	–20 dB to +62 dB in 8 Ranges

Accuracy

DC Voltage	±3% of full scale value except: ±4% of full scale value for 0.125 – 2.5 V, 500 V and 1000 V
AC Voltage	±4% of Full Scale Value
DC Current	±3% of Full Scale Value
Resistance	±3% of Full Scale Length
DC Sensitivity	50,000 Ω/V when Range Doubler Switch is in V/2•A/2 Position 25,000 Ω/V when Range Doubler Switch is in V-Ω-A Position
AC Sensitivity	10,000 Ω/V when Range Doubler Switch is in V/2•A/2 Position 5,000 Ω/V when Range Doubler Switch is in V-Ω-A Position

Meter Movement	4½-Inch, 3-Color, Mirrored Scale, 18 µA Full Scale
Buzzer Continuity	< 300 Ω (Approximate)
Batteries	One 1.5V AA Battery (Cat. No. 23-582 or 23-552) and One 9V Battery (Cat. No. 23-583 or 23-553)
Test Leads	Banana Plug Style
Dimensions	$6\frac{5}{8} \times 5\frac{3}{16} \times 1\frac{13}{16}$ Inches (168 × 132 × 46 mm)
Weight	12 Ounces (340 g)

CONTROLS AND FUNCTIONS

Scales — Three-color scale with mirror; green scale for ohms readings, red scale for ACV readings, and black scale for DCV, DCA, and dB readings.

Zero-Adjust Screw — Use to set the pointer exactly over the 0 at the left side of the AC/DC scale for ACV, DCV, DCA, and dB measurements.

Ohms-Adjust Control — Use to bring the pointer to 0 on the **OHMS** scale when measuring resistance in each **OHMS** range.

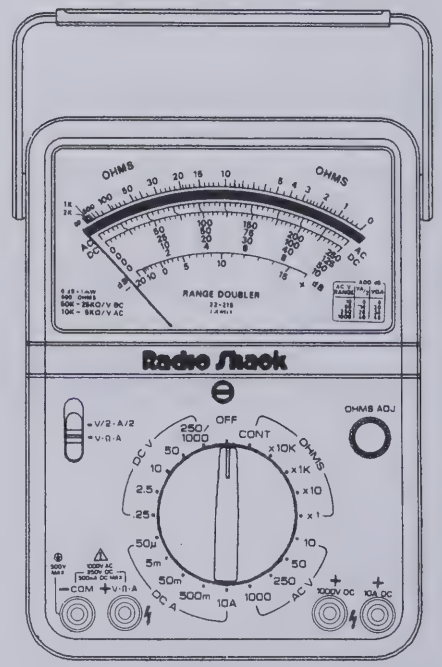
Range-Doubler Switch — Use to divide the range setting by two if the meter reading is not in the upper half of the scale during the initial measurement.

–COM Jack — Plug in the black test lead here for all measurements. Do not connect this jack to any source of more than 500 volts with respect to earth ground.

+V-Ω-A Jack — Plug in the red lead here for all measurements, except DC voltage measurements above 250 volts and DC current measurements above 500 mA. The maximum AC voltage measured here is 1000 VAC.

+1000V DC Jack — Plug in the red lead here when measuring DC voltage between 250 and 1000 volts.

+10A DC Jack — Plug in the red lead here only when measuring DC current of 500 mA to 10 A.



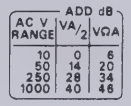
INCLUDED ACCESSORIES

Spare Fuse —Cat. No. 270-1271 - 250V, 0.5A. Stored inside the tester.

Banana Plug Style Test Leads — Cat. No. 278-704.

SPECIAL PANEL MARKINGS

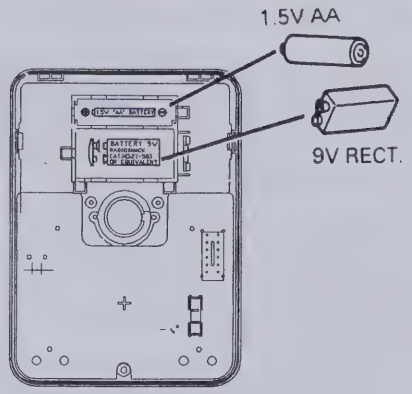
These special markings are added to the multitester's panel to remind you of important measurement limitations and safety precautions.

500V MAX ⏚	To avoid electrical shock and/or instrument damage, do not connect the common input terminal (– jack) to any source of more than 500 volts with respect to earth ground.
	Refer to the complete operating instructions.
1000V AC 250V DC 500mA DC MAX	The maximum voltage or current between these terminals is 1000 VAC, 250 VDC, and 500 mA DC.
	Be extra careful when making measurements for high voltage; do not touch terminals or test lead tips.
50K – 25KΩ/V DC 10K – 5KΩ/V AC	The multitester's inner resistance is 50 kΩ (DC) or 10 kΩ (AC) per volt with the range doubler switch set to V/2•A/2; 25 kΩ (DC) or 5 kΩ (AC) per volt with the range doubler switch in the V-Ω-A position.
0 dB = 1 mW 600 OHMS	0 dB means that 1 milliwatt is dissipated in a 600Ω impedance device.
	Add the appropriate number in this chart to the dB scale reading.

PREPARATION

INSTALLING/REPLACING THE BATTERIES

You need to install one 9V battery (Cat. No. 23-583 or 23-553) for the 20 MΩ (**x 10k**) and the continuity range, and one 1.5V AA battery (Cat. No. 23-582 or 23-552) for other resistance measurements. Follow these steps to install fresh batteries.



1. Disconnect the test leads from the circuit you are measuring.
2. Set the range switch to **OFF**.
3. Open the cabinet by removing the screw from the back, and remove the old batteries, if necessary.
4. Install the batteries as indicated by the polarity symbols (+ and –) in the battery compartment diagram.
5. Close the cabinet and replace the screw.

Replace the batteries if:

- You cannot bring the pointer to 0 on the **OHMS** scale on each range of the Ohms function by touching the test lead tips together.
- The buzzer does not sound on the **CONT** range when you touch the test lead tips together.

Cautions:

- Never leave weak or dead batteries in your tester. Even leak-proof batteries can leak damaging chemicals.
- Remove the batteries if you do not plan to use the tester for a week or more.

REPLACING THE FUSE

The tester uses an internal fuse to prevent an accidental voltage overload. The fuse blows if voltage is applied when the tester is in the **OHMS** or current range (except the 10A range), or when excess voltage is applied in the 0.25 DCV/0.125 DCV range. When the fuse blows, the meter stops working.

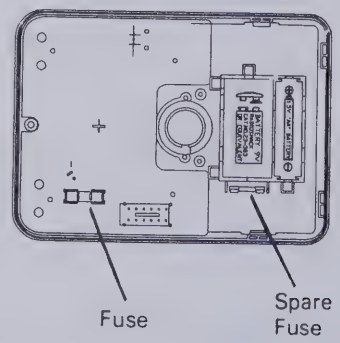
Warning: To avoid electric shock, disconnect the test leads from the circuit under test before removing the fuse.

Caution: For continued protection, replace with a fuse of the same type and rating. We recommend a 0.5A/250V fuse such as Cat. No. 270-1271.

To replace the fuse:

1. Disconnect the test leads from the circuit under test.
2. Set the range switch to **OFF**.
3. Open the tester cabinet by removing the screw from the back.

   There are two fuses in the tester. The circuit fuse is in the metal fuse holder on a board with a red ribbon ring around it. Check this fuse when the tester stops working.
4. Remove the blown fuse by pulling the red ribbon ring.
5. Place the ribbon on the replacement fuse.
6. Insert the replacement fuse into the metal fuse holder.
7. Close the tester cabinet and replace the screw.



OPERATION

METER READING

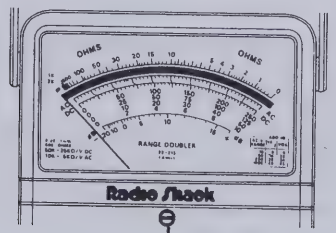
- Keep the tester on a flat, non-metallic surface for the most accurate readings.
- Select a setting that gives a reading in the upper ⅓ or ½ of the meter scale.
- When you read the scale, look at it from the point where the pointer and its reflection in the mirror come together.
- Read from the scale that matches the color of the function you select – green for **OHMS**, red for **ACV**, and black for **DCV/DCA** and decibels.

To read the AC/DC scale, use the appropriate markings based on the selected range.

Marking	Selected Range
0 to 250	0.25, 2.5, 25, 250
0 to 125	0.125, 1.25, 125
0 to 50	5, 50, 500
0 to 10	10, 1000

ZERO ADJUSTMENT

If the pointer does not normally rest exactly over the zero at the left side of the **AC/DC** scale, adjust the plastic screw in the center of the tester face to bring the pointer to zero.



Zero Ajust Screw

OHMS ADJUSTMENT

When measuring resistance on each **OHMS** range, you must bring the pointer to 0 at the right side of the upper green **OHMS** scale.

To do this, connect the black test lead to the **-COM** jack and the red test lead to the **+V-Ω-A** jack. Set the range switch to one of the OHMS positions. Then touch the test lead tips together, and adjust **OHMS ADJ** to bring the pointer to 0 on the right side of the **OHMS** scale.

Notes:

- You must do this adjustment whenever you change the **OHMS** range.
- If you cannot adjust the pointer to 0 on the **OHMS** scale when the range switch is set to the **x1**, **x10**, or the **x1K** position, replace the 1.5V AA battery.
- If you cannot adjust the pointer to 0 on the **OHMS** scale when the range switch is set to the **x10K** position, replace the 9V battery.

RANGE-DOUBLER SWITCH

If the reading is in the lower half of the scale when you measure ACV, DCV, DCA, or dB, set the range doubler switch to the **V/2•A/2** position to divide the range setting by two. This gives you more accurate readings.

When you use the **V/2•A/2** setting, divide the range switch setting by two and read the appropriate scale.

Examples:

- The range switch is set to **250 AC V** and the range doubler switch is set to **V/2•A/2**: The range is 125 volts (250 divided by 2) and you should read the red scale, following the 0 to 125 markings.
- The range switch is set to **10A** and the range doubler switch is set to the **V/2•A/2** (the black test lead is connected to the **-COM** jack and the red test lead to the **+10A DC** jack). The range is 5A (10 divided by 2), and you should read the black scale, following the 0 to 50 markings.

USING THE TEST LEADS

Use only the same type of test leads supplied with your tester. These test leads are rated for 1200 volts. Replacement test leads (Cat. No. 278-704) are available at your local Radio Shack store.

Caution: Although these test leads are rated for 1200 volts, the maximum rating of the tester is 1000 VAC/DC. Do not attempt to measure any voltage greater than 1000 VAC/DC.

Always observe correct test lead polarity when making DC measurements. The black lead should always be connected to the **–COM** jack. If you connect using the wrong polarity, the tester's pointer swings to the left and goes out of range. Connect the red lead to the **+V-Ω-A** jack for making DC voltage measurements up to 250 V, DC current up to 500 mA, all AC voltages (up to 1000 VAC), and all resistance measurements.

Connect the red lead to the **+1000V DC** jack when measuring DC voltages from 250-1000 V. Connect the red lead to the **+10A DC** jack when measuring DC current from 500 mA to 10 A.

Warning: Never allow your fingers to touch the bare metal portion of the test leads (or circuit points) during measurements.

Caution: Always disconnect the test leads when you have finished using the tester.

DC VOLTAGE MEASUREMENTS

Warning: Use extreme care when making high-voltage measurements. Do not touch the terminal or test lead tips.

1. Plug the black test lead into the **–COM** jack.
2. Plug the red test lead into the **+V-Ω-A** jack if the voltage to be measured is under 250V. For voltages between 250-1000V, plug the red test lead into the **+1000V DC** jack.

   If you do not know the voltage level, plug the red test lead into the **+1000V DC** jack and start with the **250/1000V** range. If the meter reading is in the lower half of the scale, plug the red test lead into the **V-Ω-A** jack and lower the range using the range and range doubler switches until the reading is in the upper ½ or ⅓ of the scale.

   Note: Use the **+1000V DC** jack only with DC voltages of 250 to 1000V.
3. Set the range switch to one of the **DCV** positions.

   Caution: When excess voltage is applied to the **0.25 DCV** or **0.125 DCV** range, the fuse in the tester will blow, and the tester does not work until you replace the fuse.
4. Connect the test lead tips to the circuit to be tested, with the red lead to the positive supply and the black lead to the negative supply.
5. Set the range and the range doubler switches to get a meter reading in the upper ½ or ⅓ of the scale.
6. Read the voltage on the black **DC** scale.

If the range doubler switch is set to **V/2•A/2**, divide the range switch setting by two and read the appropriate scale.

AC VOLTAGE MEASUREMENTS

Warning: Use extreme care when making high-voltage measurements. Do not touch the terminal or test lead tips.

1. Plug the black test lead into the **–COM** jack and the red lead into the **+V-Ω-A** jack.
2. Set the range switch to one of the **ACV** positions. If you are uncertain about the level of the voltage to be measured, it is best to start at the highest range (**1000V**) and work down the scale.
3. Connect the test lead tips to the circuit to be tested.
4. Set the range and the range doubler switches as required to get a meter reading in the upper ½ or ⅓ of the scale.
5. Read the voltage on the red **AC** scale, following the black numbers printed below the red scale.

If the range doubler switch is set to the **V/2•A/2** position, divide the range switch setting by two and read the appropriate scale.

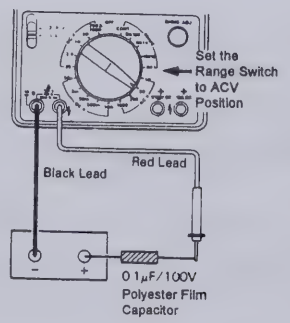
HIGH-VOLTAGE MEASUREMENTS

When you use the tester to probe for a voltage in a high-voltage circuit, we recommend that you do not try to position both of the test leads at once. Instead, clamp one lead to the neutral or ground lead of the circuit, using Radio Shack insulated slip-on alligator clips (Cat. No. 270-354). Then probe for voltages with the other probe and put your free hand in your pocket. This helps prevent you from accidentally touching a hot wire, since you need only concentrate on one test lead.

Warning: Never clamp to a hot wire. If you do and then touch the other probe connected to the tester, you could receive an electric shock.

AC VOLTAGE RIDING ON A DC SOURCE BIAS MEASUREMENTS

When measuring an AC voltage superimposed on a DC voltage source bias, you cannot make ordinary measurements. In this situation, if you know the approximate voltage of the device to be measured and the voltage is under 30V AC on a DC source bias, you can measure the voltage by connecting a 0.1 µf/100 V polyester film capacitor in series with the positive terminal of the voltage source and the red test lead. Set the range switch to either the 10 or 50 **ACV** position.



Warning: Do not make this type of measurement if the AC voltage is greater than 100V with respect to earth ground.

MEASURING 3-PHASE AC VOLTAGES

We designed your meter to measure household AC voltage. It is not intended for commercial or industrial use. Please note the following regarding 3-phase AC voltages.

Warnings:

- Because of the dangers inherent in measuring 3-phase circuits, do not use this meter for such applications. The actual voltage can be greater than the circuit's rated line-to-ground voltage.
- To determine the line-to-line voltage, multiply the rated line-to-ground voltage by 1.732 (the square root of 3).

  For example, if the rated line-to-ground voltage is 640 volts, the line-to-line voltage is:

  $640 \times 1.732 = 1108$ Volts

  This voltage exceeds the meter's rating and you should not connect the meter to this circuit.

RESISTANCE MEASUREMENTS

Warning: Do not apply voltage to the test leads when the range switch is in an **OHMS** position. Doing so causes the fuse to blow, and the tester stops working.

Before taking any resistance measurements, disconnect power to the unit under test and discharge any capacitors. It is best to remove any batteries from the unit under test and unplug any line cords.

To make resistance measurements:

1. Plug the black test lead into the **–COM** jack and the red test lead into the **+V-Ω-A** jack.
2. Leave the range doubler switch in the **V-Ω-A** position.
3. Set the range switch to one of the **OHMS** positions.
4. Touch the test lead tips together and adjust **OHMS ADJ** to bring the pointer to 0 at the right side of the green **OHMS** scale.

   Note: You must adjust the pointer to 0 each time you change ranges in the **OHMS** function (except the **CONT** position). If you cannot adjust the pointer to 0, replace the battery. See "Installing/Replacing the Batteries."
5. Connect the test lead tips across the circuit or part under test.

   Note: When measuring a part's resistance, disconnect one side of the component under test so the remainder of the circuit does not interfere with the readings.
6. Read the resistance on the green **OHMS** scale.
7. Use the appropriate multiplier to find the correct resistance value. Multiply the value that the pointer indicates in the scale by 1, 10, 1000, or 10,000 depending on the range switch's position.

When trying to identify the cathode and anode ends or the type of transistor (PNP or NPN), the actual poliarity of the tester's voltage is the opposite of the test lead colors. The red test lead is the negative source and the black test lead is positive.

CONTINUITY CHECK

Follow these steps to check for continuity in a wire or circuit.

1. Plug the black test lead into the **–COM** jack and the red test lead into the **+V-Ω-A** jack.
2. Set the range switch to **CONT** on the **OHMS** range.
3. Touch the test lead tips together to check the built-in buzzer.
   If the buzzer does not sound, replace the 9V battery.
4. Connect the test leads to the unit under test.

If the resistance is between 0 and 300Ω, the built-in buzzer sounds.

Note: The buzzer's sound level decreases as the resistance increases.

DC CURRENT MEASUREMENTS

To measure current, you must break the circuit and connect the test leads in series with the circuit.

Warning: Do not apply voltage to the test leads when the range switch is set to a **DCA** position. Doing so blows the fuse, and the meter stops working.

Note: The 10A range is not fuse protected.

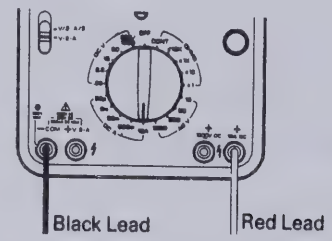
1. Set the range switch to one of the **DCA** positions.

   If you do not know the current level to be measured, start at the highest **10A** range, then lower the range using the range doubler and range switches.

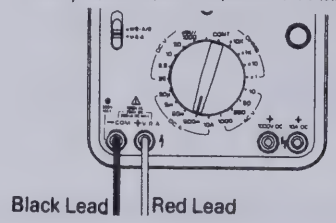
2. Connect the red test lead to:
   - **+10A DC** to measure current over 500 mA and under 10 A.
   - **+V-Ω-A** to measure current of 500 mA or less.
3. Connect the black test lead to the **–COM** jack.
4. Remove power from the circuit under test and break the circuit at the appropriate point.
5. Connect the test leads in series with the circuit (black lead to the negative side and red lead to the positive side).
6. Apply power to the circuit under test.
7. Set the range doubler and range switches as required to get a reading in the upper ½ or ⅓ of the scale.
8. Read the current on the black **DC** scale.

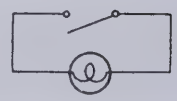
   Note: If you set the range doubler switch to **V/2•A/2**, divide the range switch setting by two and read the scale.

10A Range



50 µA/5 mA/50 mA/500 mA Range





DECIBEL MEASUREMENTS

1. Plug the black test lead into the **–COM** jack and the red test lead into the **+V-Ω-A** jack.
2. Set the range switch to one of the **ACV** positions.
3. Connect the test lead tips to the circuit under test.
4. Set the range doubler switch as required to get a reading in the upper ½ or ⅓ of the scale.
5. Read the lower black **dB** scale, adding the appropriate number of decibels to the **dB** scale as noted on the chart at the lower right of the scale. For example, if the pointer indicates +12 dB and the range switch is set to **50 AC V** and the range doubler switch is set to **V/2•A/2**, add 14 decibels to the indicated value. The result is +26 dB.

   Note: For the most accurate decibel readings, the circuit impedance must be 600Ω.

CARE AND MAINTENANCE

Your Radio Shack Range Doubler Multitester is an example of superior design and craftsmanship. The following suggestions will help you care for the meter so you can enjoy it for years.

Keep the meter dry. If it gets wet, immediately wipe it dry. Liquids can contain minerals that can corrode the electronic circuits.

Use and store the meter only in normal temperature environments. Temperature extremes can shorten the life of electronic devices, damage batteries, and distort or melt plastic parts.

Handle the meter gently and carefully. Dropping it can damage the circuit boards and cause the meter to work improperly.

Wipe the meter with a damp cloth occasionally to keep it looking new. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the meter.

Use only fresh batteries of the recommended size and type. Always remove old or weak batteries. They can leak chemicals that destroy electronic circuits.

Keep the meter away from dust and dirt, which can cause parts to wear prematurely.

Modifying or tampering with your meter's internal components can cause a malfunction and might invalidate the meter's warranty. If your meter is not performing as it should, take it to your local Radio Shack store for assistance.

NOTES

RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 90 days from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

EXCEPT AS PROVIDED HEREIN, RADIO SHACK MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Some states do not permit limitation or exclusion of implied warranties; therefore, the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state

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OPERATING INSTRUCTIONS FOR THE

MICRONTA®

TRANSISTOR TESTER

Catalog No. 22-024

CUSTOM MANUFACTURED FOR

RADIO SHACK A DIVISION OF TANDY CORPORATION

MICRONTA

OPERATING INSTRUCTIONS:

Radio Shack's new 'Micronta' Transistor Tester is capable of ckecking a wide range of transistor types, either "in circuit" or out of circuit. It has been specially designed to take advantage of the newest concept of dynamic testing under current amplifier conditions.

To use, simply plug the transistor to be checked into the front panel socket, or connect it with the alligator clip test leads provided. No preliminary set-up is needed The unit safely and automatically identifies low, medium and high-power PNP and NPN transistors.

It provides a visual indication of signal output, giving positive information on the following tests simultaneously:

(A) Electrode Open Circuits
(B) Short Circuits
(C) Current Gain

The visual indication of the output signal is the result of dynamic current gain in an actual operating circuit. Further leakage tests are unnecessary, as the dynamic distribution of leakage is taken into account in testing.

The 'Micronta' Transistor Tester also permits matching similar transistors in actual operating circuits, and provides a reliable GO/NO-GO test at practical collector currents (from 5 ma on small signal types to 50 ma and more on power types). Match similar type transistors by observing and comparing dial readings; the higher the reading, the higher the gain.

To determine distributed leakage, note the firing point of the lamp. The brilliance of the neon lamp gives an indication of greater or lesser output. An adjustable base current control allows you to test transistors over a broad range of current conditions. If operation at increased current is desired, an additional load resistor may be inserted in the jacks.

The use of an AC voltmeter or oscilloscope as an output indicator will show a measurable output on collector currents as low as 5 ma. Jacks are provided for use with these instruments for:

(1) providing amplitude signal output indications
(2) making sensitive noise tests
(3) studying dynamic leakage distribution
(4) wave form inspection

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1. Turn base current control knob to "0".
2. Turn lamp switch to "ON".
3. Set PNP/NPN slide switch selector to the type under test. If you do not know the correct type, see Step 6 below.
4. Insert transistor in socket or connect test leads: E (black), B (green), C (red).
5. Neon indicator lamp will glow if transistor is providing current amplification; this means it is not "open" or "shorted".
6. CAUTION: Transistors will fire the indicator lamp only if the NPN/PNP selector switch is set in correct position. However, no damage can occur with switch in wrong position as long as the base current control knob points to "0".
7. To match similar type transistors: note the dial setting at which the lamp glows or output "drops out". The higher this setting, the greater the gain will be, since the base current decreases as the setting is turned towards "100". Maximum base and collector currents occur at "0".
8. Power types should be tested with control knob set to "POWER TYPES". Match as indicated above.
9. If ample output is available, attach the collector lead to the battery contained in the test unit.
10. In case of excessive loading, isolate the transistor's emitter lead and attach the "E" test lead to the emitter lead, continuing test with all other leads in place.
11. Type selector switch should be left in OFF (center) position when instrument is not in use

IN-CIRCUIT TEST PROCEDURE:

For in-circuit testing, the resistor R1 is shorted by switching control knob to POWER TYPES position. Attach test leads to the in-circuit transistor. If a radio or an audio amplifier is being tested, its gain controls should be set at maximum in order to minimize base circuit loading. On the great majority of transistors, the output will be sufficient to fire the neon indicator. If the radio is turned on, the generated tone will also serve as a signal injector, and the output tone will be heard in the speaker. If the tester's built-in power supply furnishes too little output, the collector may be moved to the collector supply end of the battery; this increases the collector voltage, but does not change the base current supply.

CHECKING VERY LOW CURRENT TRANSISTORS:

1. If the output is not high enough to operate the indicator lamp, use a voltmeter (preferably a VTVM type) or an oscilloscope to get an output indication.
2. Set control knob at "POWER TYPES" and note change, if any.
3. Rotate base current control from "0" through "100" and note whether output is best at some point other than the usual "0" position.

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The 'Micronta' Transistor Tester also permits matching similar transistors in actual operating circuits, and provides a reliable GO/NO-GO test at practical collector currents (from 5 ma on small signal types to 50 ma and more on power types). Match similar type transistors by observing and comparing dial readings; the higher the reading the higher the gain.

To determine distributed leakage, note the firing point of the lamp. The brilliance of the neon lamp gives an indication of greater or lesser output. An adjustable base current control allows you to test transistors over a broad range of current conditions If operation at increased current is desired, an additional load resistor may be inserted in the jacks.

The use of an AC voltmeter or oscilloscope as an output indicator will show a measurable output on collector currents as low as 5 ma. Jacks are provided for use with these instruments for:

(1) providing amplitude signal output indications
(2) making sensitive noise tests
(3) studying dynamic leakage distribution
(4) wave form inspection

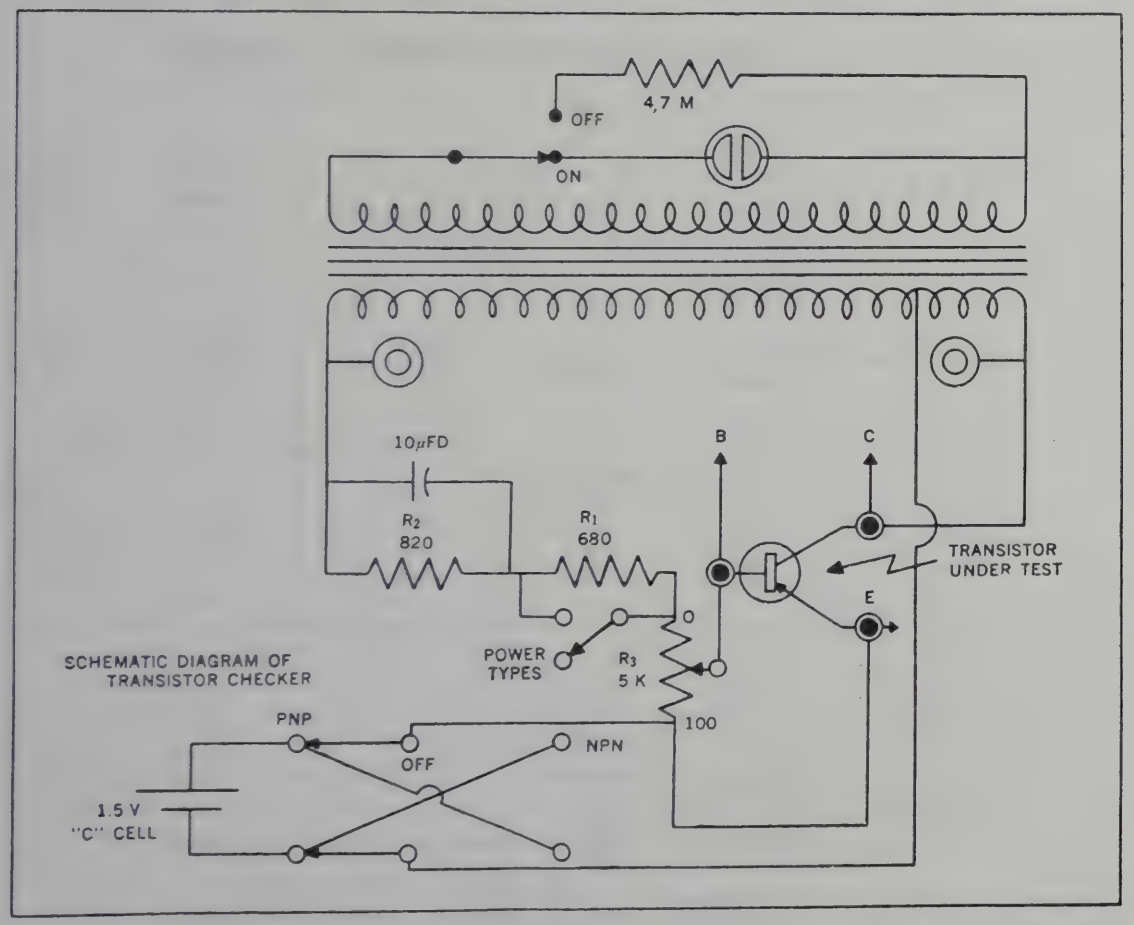
PRINCIPLES OF OPERATION:

A specially designed pulse signal generator is utilized in the Transistor Tester. With a transistor connected to the test instrument, the AC signal developed in the primary winding is stepped up to the voltage necessary to fire the neon glow lamp (#NE-51)

The brightness of the indicator lamp varies in direct proportion to the signal output; hence, the greater the output, the brighter the lamp will glow. When using this unit with a voltmeter or scope, the lamp switch is opened (OFF) to prevent clipping or limiting due to the lamp being left in the circuit.

For "quick check" applications, set the base current control knob at "0". Advancing the knob will then reduce the base current to establish the power operating collector currents. The higher the dial reading at the point a given transistor drops out of operation, the higher the gain

(Refer to Schematic Diagram Below)



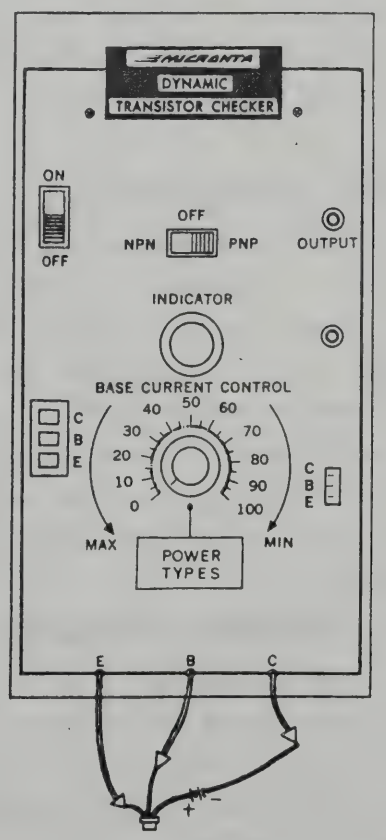
The "GO/NO-GO" position is for "quick-check" use. R1 is normally shorted out on small-signal transistors, and open on power types. R3 serves as a base current control, and also furnishes feedback control. (Feedback and base current are maximum at GO/NO-GO.)

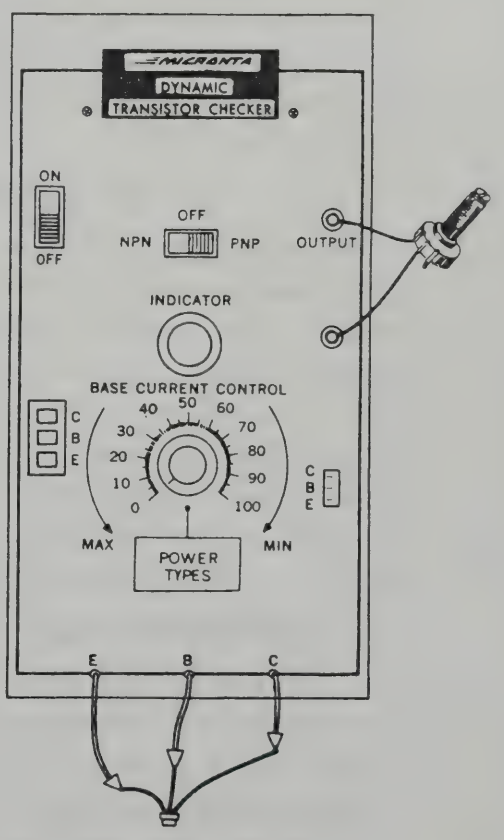
In matching similar type transistors, observe the point of output signal "dropout". Minimum base current occurs at "100". If the dynamic leakage distribution of both transistors under test is similar, then oscillation "dropout" will occur at the same dial setting for each. Naturally, since the dial is not calibrated, these reading will serve for comparison purposes only.

To take advantage of the maximum versatility available in the Transistor Tester, you will want to note these suggestions:

By connecting extra batteries in series with the collector leads, increased operating potential is available (see Fig. 1).
By connecting a 500 ohm variable resistor across the output jacks, increased current loading is possible on power type transistors (see Fig. 2).

OPERATING INSTRUCTIONS:





1. Turn base current control knob to "0".
2. Turn lamp switch to "ON".
3. Set PNP/NPN slide switch selector to the type under test. If you do not know the correct type, see Step 6 below.
4. Insert transistor in socket or connect test leads: E (black), B (green), C (red).
5. Neon indicator lamp will glow if transistor is providing current amplification; this means it is not "open" or "shorted".
6. CAUTION: Transistors will fire the indicator lamp only if the NPN/PNP selector switch is set in correct position. However, no damage can occur with switch in wrong position as long as the base current control knob points to "0".
7. To match similar type transistors: note the dial setting at which the lamp glows or output "drops out". The higher this setting, the greater the gain will be, since the base current decreases as the setting is turned towards "100". Maximum base and collector currents occur at "0".
8. Power types should be tested with control knob set to "POWER TYPES". Match as indicated above.
9. If ample output is available, attach the collector lead to the battery contained in the test unit.
10. In case of excessive loading, isolate the transistor's emitter lead and attach the "E" test lead to the emitter lead, continuing test with all other leads in place.
11. Type selector switch should be left in OFF (center) position when instrument is not in use

IN-CIRCUIT TEST PROCEDURE:

For in-circuit testing, the resistor R1 is shorted by switching control knob to POWER TYPES position. Attach test leads to the in-circuit transistor. If a radio or an audio amplifier is being tested, its gain controls should be set at maximum in order to minimize base circuit loading. On the great majority of transistors, the output will be sufficient to fire the neon indicator. If the radio is turned on, the generated tone will also serve as a signal injector, and the output tone will be heard in the speaker. If the tester's built-in power supply furnishes too little output, the collector may be moved to the collector supply end of the battery; this increases the collector voltage, but does not change the base current supply.

CHECKING VERY LOW CURRENT TRANSISTORS:

1. If the output is not high enough to operate the indicator lamp, use a voltmeter (preferably a VTVM type) or an oscilloscope to get an output indication.
2 Set control knob at "POWER TYPES" and note change, if any.
3. Rotate base current control from "0" through "100" and note whether output is best at some point other than the usual "0" position.

4. Insert additional batteries in series with the collector lead only. Observe polarity: negative end of battery goes to collector on PNP types; positive end on NPN. See schematic diagram.
5. Since the neon lamp loads the transformer only when it is glowing, keeping the lamp switch in the "ON" position while checking very low outputs will provide greater output at the test jacks. A 470 ohm resistor loads the transformer when lamp is "OFF".

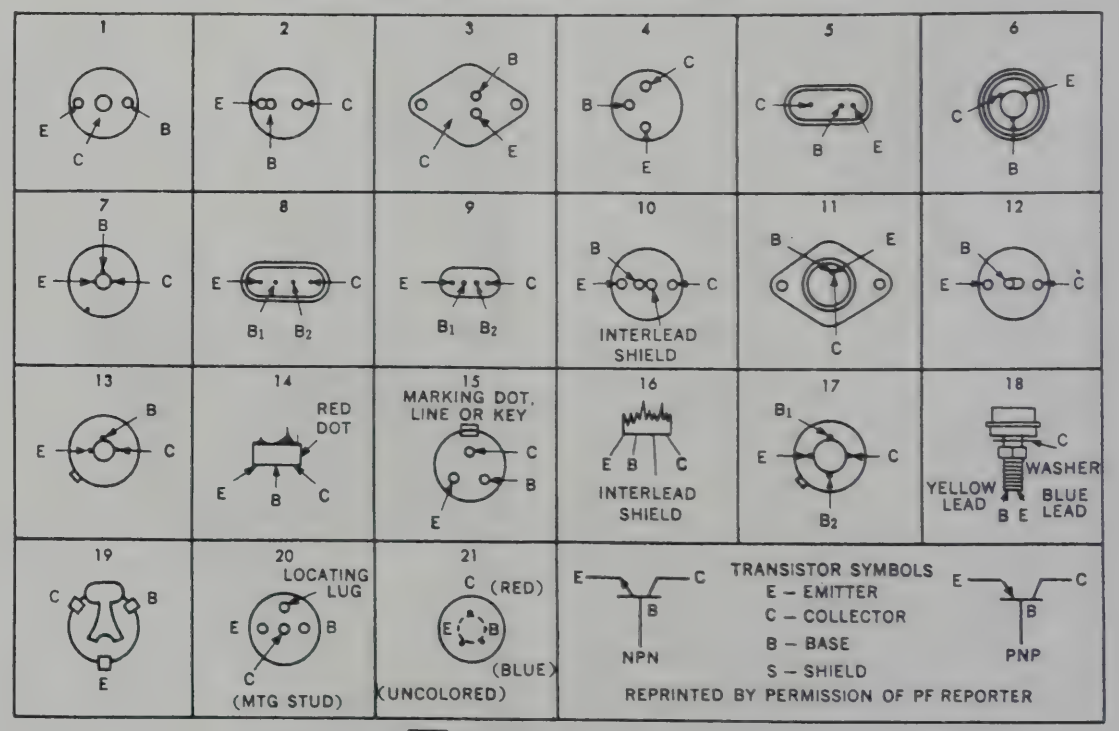
NOTE:

To check battery condition, touch the E and C test clips together briefly; neon lamp should flash if battery is in good condition.

When the voltage across a 100 ohm resistor connected between E and C reads less than 1.1 volts DC, replace battery with a fresh one.

Never operate the tester with the neon lamp out of its socket! The lamp serves as a voltage limiter and regulator, and without it, dangerously high voltages can result.

TRANSISTOR SYMBOL CHART



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6A6

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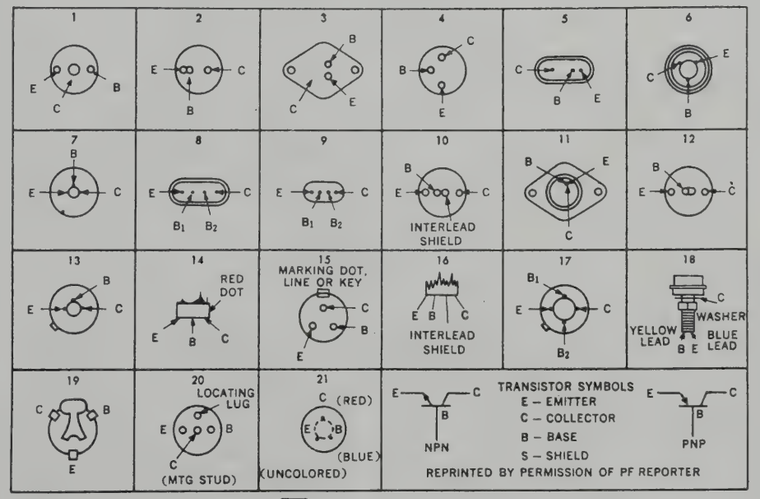

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TANDY CORPORATION

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280-316 VICTORIA ROAD RYDALMERE, N.S.W. 2116	PARC INDUSTRIEL DE NANINNE 5140 NANINNE	BILSTON ROAD WEDNESBURY, STAFFS WS10 7JN

6A6

Printed in Japan

OPERATING INSTRUCTIONS FOR THE

MICRONTA®

TRANSISTOR TESTER

Catalog No. 22-024

CUSTOM MANUFACTURED FOR

RADIO SHACK A DIVISION OF TANDY CORPORATION

MICRONTA

OPERATING INSTRUCTIONS:

Radio Shack's new 'Micronta' Transistor Tester is capable of ckecking a wide range of transistor types, either "in circuit" or out of circuit. It has been specially designed to take advantage of the newest concept of dynamic testing under current amplifier conditions.

To use, simply plug the transistor to be checked into the front panel socket, or connect it with the alligator clip test leads provided. No preliminary set-up is needed The unit safely and automatically identifies low, medium and high-power PNP and NPN transistors.

It provides a visual indication of signal output, giving positive information on the following tests simultaneously:

(A) Electrode Open Circuits
(B) Short Circuits
(C) Current Gain

The visual indication of the output signal is the result of dynamic current gain in an actual operating circuit. Further leakage tests are unnecessary, as the dynamic distribution of leakage is taken into account in testing.

The 'Micronta' Transistor Tester also permits matching similar transistors in actual operating circuits, and provides a reliable GO/NO-GO test at practical collector currents (from 5 ma on small signal types to 50 ma and more on power types). Match similar type transistors by observing and comparing dial readings; the higher the reading, the higher the gain.

To determine distributed leakage, note the firing point of the lamp. The brilliance of the neon lamp gives an indication of greater or lesser output. An adjustable base current control allows you to test transistors over a broad range of current conditions. If operation at increased current is desired, an additional load resistor may be inserted in the jacks.

The use of an AC voltmeter or oscilloscope as an output indicator will show a measurable output on collector currents as low as 5 ma. Jacks are provided for use with these instruments for:

(1) providing amplitude signal output indications
(2) making sensitive noise tests
(3) studying dynamic leakage distribution
(4) wave form inspection

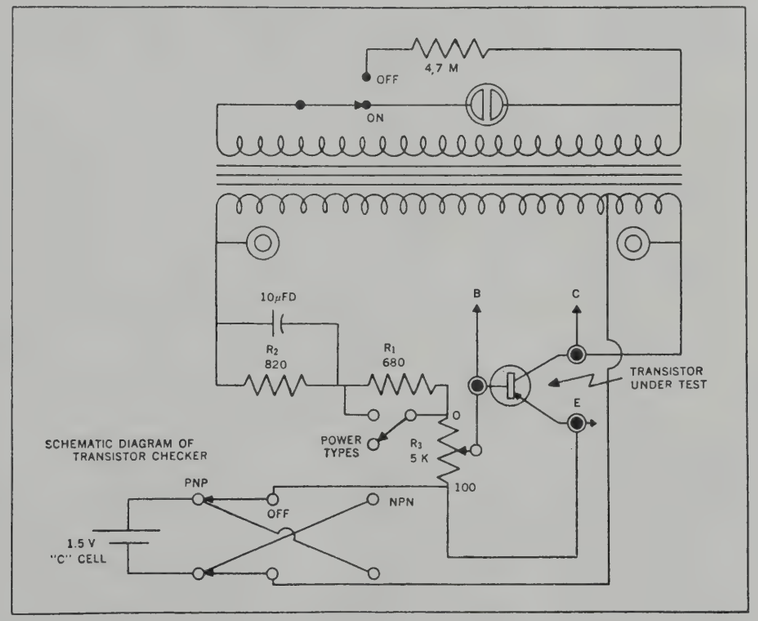
PRINCIPLES OF OPERATION:

A specially designed pulse signal generator is utilized in the Transistor Tester. With a transistor connected to the test instrument, the AC signal developed in the primary winding is stepped up to the voltage necessary to fire the neon glow lamp (#NE-51)

The brightness of the indicator lamp varies in direct proportion to the signal output; hence, the greater the output, the brighter the lamp will glow. When using this unit with a voltmeter or scope, the lamp switch is opened (OFF) to prevent clipping or limiting due to the lamp being left in the circuit.

For "quick check" applications, set the base current control knob at "0". Advancing the knob will then reduce the base current to establish the power operating collector currents. The higher the dial reading at the point a given transistor drops out of operation, the higher the gain

(Refer to Schematic Diagram Below)



The "GO/NO-GO" position is for "quick-check" use. R1 is normally shorted out on small-signal transistors, and open on power types. R3 serves as a base current control, and also furnishes feedback control. (Feedback and base current are maximum at GO/NO-GO.)

In matching similar type transistors, observe the point of output signal "dropout". Minimum base current occurs at "100". If the dynamic leakage distribution of both transistors under test is similar, then oscillation "dropout" will occur at the same dial setting for each. Naturally, since the dial is not calibrated, these reading will serve for comparison purposes only.

To take advantage of the maximum versatility available in the Transistor Tester, you will want to note these suggestions:

By connecting extra batteries in series with the collector leads, increased operating potential is available (see Fig. 1).
By connecting a 500 ohm variable resistor across the output jacks, increased current loading is possible on power type transistors (see Fig. 2).

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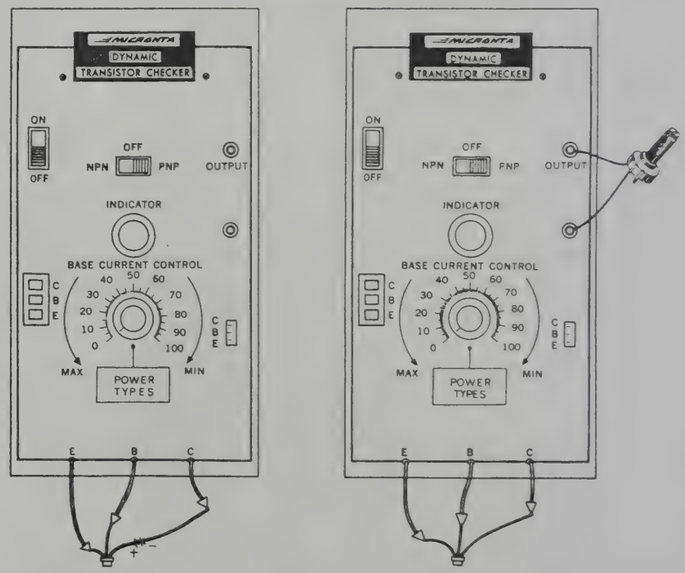

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1. Turn base current control knob to "0".
2. Turn lamp switch to "ON".
3. Set PNP/NPN slide switch selector to the type under test. If you do not know the correct type, see Step 6 below.
4. Insert transistor in socket or connect test leads: E (black), B (green), C (red).
5. Neon indicator lamp will glow if transistor is providing current amplification; this means it is not "open" or "shorted".
6. CAUTION: Transistors will fire the indicator lamp only if the NPN/PNP selector switch is set in correct position. However, no damage can occur with switch in wrong position as long as the base current control knob points to "0".
7. To match similar type transistors: note the dial setting at which the lamp glows or output "drops out". The higher this setting, the greater the gain will be, since the base current decreases as the setting is turned towards "100". Maximum base and collector currents occur at "0".
8. Power types should be tested with control knob set to "POWER TYPES". Match as indicated above.
9. If ample output is available, attach the collector lead to the battery contained in the test unit.
10. In case of excessive loading, isolate the transistor's emitter lead and attach the "E" test lead to the emitter lead, continuing test with all other leads in place.
11. Type selector switch should be left in OFF (center) position when instrument is not in use

IN-CIRCUIT TEST PROCEDURE:

For in-circuit testing, the resistor R1 is shorted by switching control knob to POWER TYPES position. Attach test leads to the in-circuit transistor. If a radio or an audio amplifier is being tested, its gain controls should be set at maximum in order to minimize base circuit loading. On the great majority of transistors, the output will be sufficient to fire the neon indicator. If the radio is turned on, the generated tone will also serve as a signal injector, and the output tone will be heard in the speaker. If the tester's built-in power supply furnishes too little output, the collector may be moved to the collector supply end of the battery; this increases the collector voltage, but does not change the base current supply.

CHECKING VERY LOW CURRENT TRANSISTORS:

1. If the output is not high enough to operate the indicator lamp, use a voltmeter (preferably a VTVM type) or an oscilloscope to get an output indication.
2. Set control knob at "POWER TYPES" and note change, if any.
3. Rotate base current control from "0" through "100" and note whether output is best at some point other than the usual "0" position.

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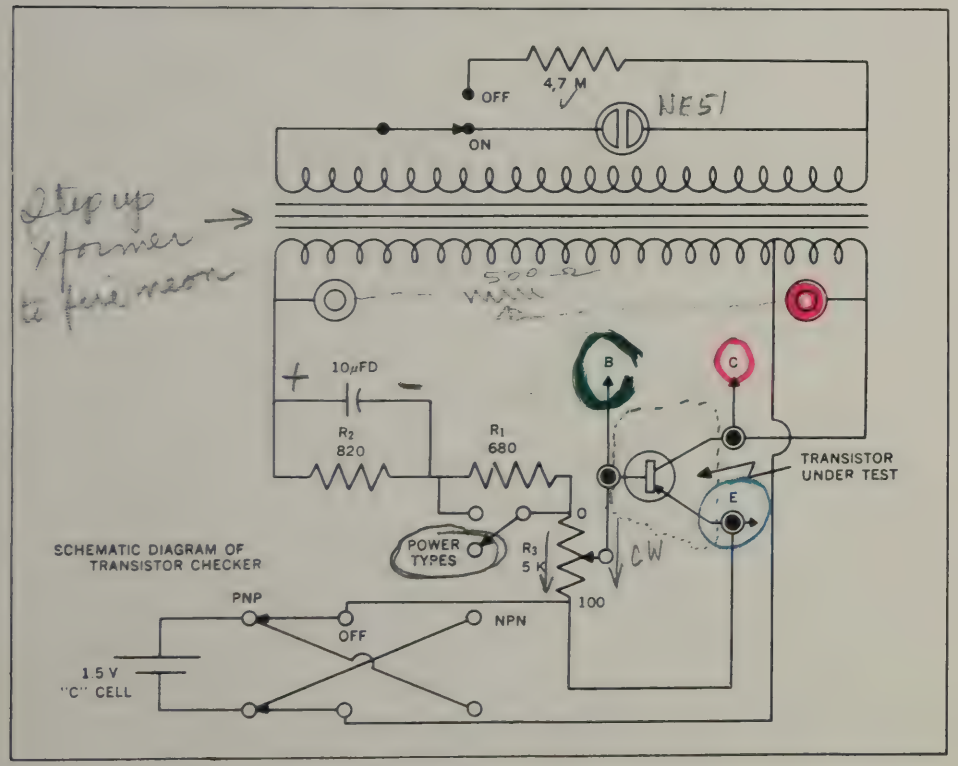

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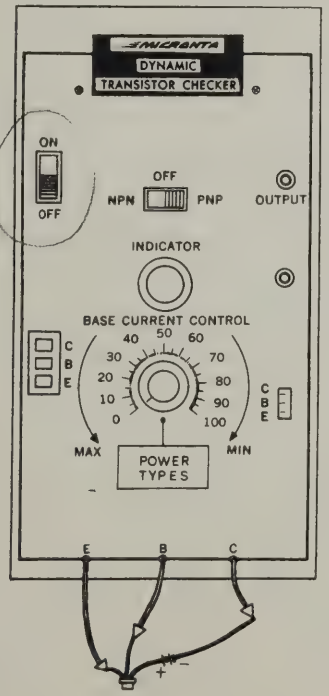
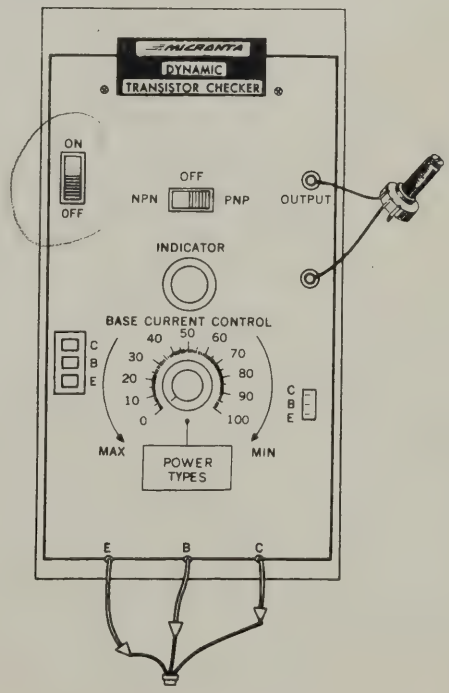




4. Insert additional batteries in series with the collector lead only. Observe polarity: negative end of battery goes to collector on PNP types; positive end on NPN. See schematic diagram.
5. Since the neon lamp loads the transformer only when it is glowing, keeping the lamp switch in the "ON" position while checking very low outputs will provide greater output at the test jacks. A ~~470~~ 4.7M ohm resistor loads the transformer when lamp is "OFF".

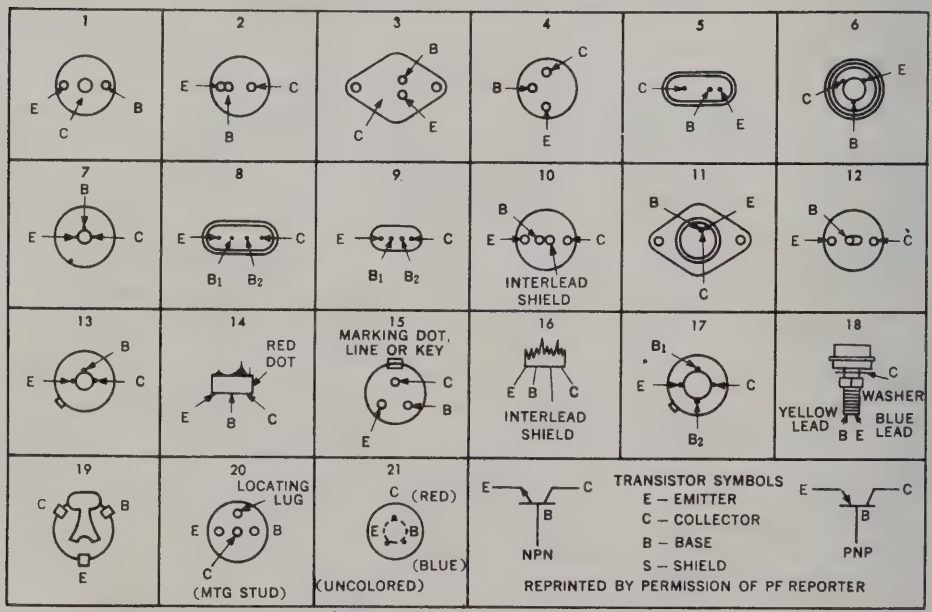
NOTE:

To check battery condition, touch the E and C test clips together briefly; neon lamp should flash if battery is in good condition.

When the voltage across a 100 ohm resistor connected between E and C reads less than 1.1 volts DC, replace battery with a fresh one.

Never operate the tester with the neon lamp out of its socket! The lamp serves as a voltage limiter and regulator, and without it, dangerously high voltages can result.

TRANSISTOR SYMBOL CHART



RADIO SHACK A DIVISION OF TANDY CORPORATION
U.S.A.: FORT WORTH, TEXAS 76102
CANADA: BARRIE, ONTARIO, CANADA L4M 4W5

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Cat. No. 22-215

NER'S MANUAL

efore using this equipment.

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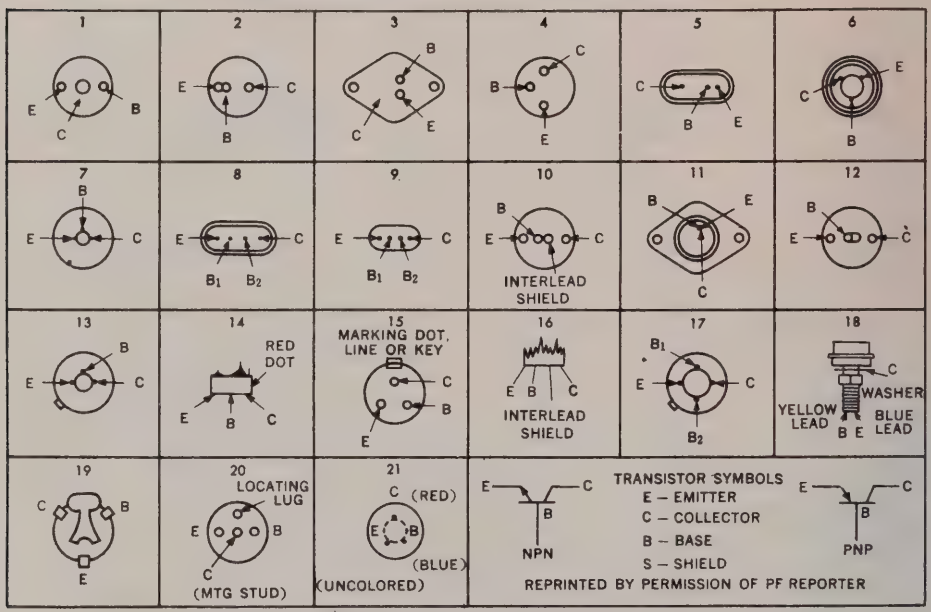

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OWNER'S MANUAL

Please read before using this equipment.

Range Doubler Multitester

Radio Shack®

FEATURES

Your Radio Shack Range Doubler Multitester is a high-sensitivity analog multitester, ideally suited for field, lab, shop, and home applications. These features make the multitester easy to use and ensure accurate and reliable operation.

Range Doubler Switch — effectively doubles the number of available AC and DC scales for greater accuracy.

Low DC Ranges — 125 mV and 25 µA — great for solid state work.

Sensitive 18 µA Meter Movement with 4½-Inch Face and Mirrored Scale — simplifies accurate reading.

Built-In Diodes and Fuse — protect meter movement and other internal parts in case of improper function selection.

Audible Continuity Function — built-in buzzer sounds when there is continuity.

Carrying Handle — can be flipped to the back to support the meter at an easy-to-read angle.

Note: You need one 9-volt and one 1.5-volt AA battery (not included) to operate this multitester.

WARNING: USE EXTREME CAUTION IN THE USE OF THIS DEVICE. IMPROPER USE OF THIS DEVICE CAN RESULT IN INJURY OR DEATH. FOLLOW ALL SAFEGUARDS SUGGESTED IN THIS OWNER'S MANUAL IN ADDITION TO NORMAL SAFETY PRECAUTIONS IN DEALING WITH ELECTRICAL CIRCUITS. DO NOT USE THIS DEVICE IF YOU ARE UNFAMILIAR WITH ELECTRICAL CIRCUITS AND TESTING PROCEDURES.

NOT FOR COMMERCIAL OR INDUSTRIAL USE.

CONTENTS

A WORD ABOUT SAFETY

We have taken every precaution in designing and manufacturing this meter to ensure that it is as safe as we can make it. But safe operation depends on you, the operator. We recommend that you follow these simple safety rules:

- Use extreme caution when working with voltages above 30 Volts AC or 60 Volts DC. Always disconnect power from the circuit you are measuring before you connect the test probes to high-voltage points.
- Never connect the test probes to a source of voltage when you select resistance, continuity, or current measurement functions. Always turn off the meter's power and disconnect the test probes before you replace the batteries or fuse.
- Never operate the meter unless the back cover is in place and fully closed. Because some AC/DC sets have a hot chassis, be sure that the top of your work bench and the floor underneath it are made of non-conductive materials.
- The meter is fully calibrated and tested. Under normal use, no further adjustment should be necessary. If the meter should require repair, do not try to adjust it yourself. Take it to your local Radio Shack store. Service by unauthorized personnel voids the warranty.

SPECIFICATIONS

Ranges

DC Voltage	125 mV/250 mV/1.25V/2.5V/5V/10V/25V/50V/125V/250V/500V/1000V
AC Voltage	5V/10V/25V/50V/125V/250V/500V/1000V
DC Current	25 µA/50 µA/2.5 mA/5 mA/25 mA/50 mA/250 mA/500 mA/5 A/10 A
Resistance	2 kΩ/20 kΩ/2 MΩ/20 MΩ/(Center Scale 10)
Decibel	–20 dB to +62 dB in 8 Ranges

Accuracy

DC Voltage	±3% of full scale value except: ±4% of full scale value for 0.125 – 2.5 V, 500 V and 1000 V
AC Voltage	±4% of Full Scale Value
DC Current	±3% of Full Scale Value
Resistance	±3% of Full Scale Length
DC Sensitivity	50,000 Ω/V when Range Doubler Switch is in V/2•A/2 Position 25,000 Ω/V when Range Doubler Switch is in V-Ω-A Position
AC Sensitivity	10,000 Ω/V when Range Doubler Switch is in V/2•A/2 Position 5,000 Ω/V when Range Doubler Switch is in V-Ω-A Position
Meter Movement	4½-Inch, 3-Color, Mirrored Scale, 18 µA Full Scale
Buzzer Continuity	< 300 Ω (Approximate)
Batteries	One 1.5V AA Battery (Cat. No. 23-582 or 23-552) and One 9V Battery (Cat. No. 23-583 or 23-553)
Test Leads	Banana Plug Style
Dimensions	$6\frac{5}{8} \times 5\frac{3}{16} \times 1\frac{13}{16}$ Inches (168 × 132 × 46 mm)
Weight	12 Ounces (340 g)

CONTROLS AND FUNCTIONS

Scales — Three-color scale with mirror; green scale for ohms readings, red scale for ACV readings, and black scale for DCV, DCA, and dB readings.

Zero-Adjust Screw — Use to set the pointer exactly over the 0 at the left side of the AC/DC scale for ACV, DCV, DCA, and dB measurements.

Ohms-Adjust Control — Use to bring the pointer to 0 on the **OHMS** scale when measuring resistance in each **OHMS** range.

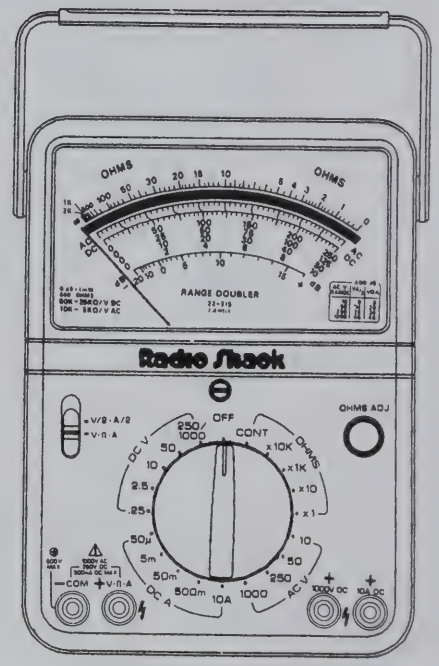
Range-Doubler Switch — Use to divide the range setting by two if the meter reading is not in the upper half of the scale during the initial measurement.

–COM Jack — Plug in the black test lead here for all measurements. Do not connect this jack to any source of more than 500 volts with respect to earth ground.

+V-Ω-A Jack — Plug in the red lead here for all measurements, except DC voltage measurements above 250 volts and DC current measurements above 500 mA. The maximum AC voltage measured here is 1000 VAC.

+1000V DC Jack — Plug in the red lead here when measuring DC voltage between 250 and 1000 volts.

+10A DC Jack — Plug in the red lead here only when measuring DC current of 500 mA to 10 A.



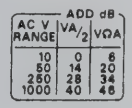
INCLUDED ACCESSORIES

Spare Fuse —Cat. No. 270-1271 - 250V, 0.5A. Stored inside the tester.

Banana Plug Styie Test Leads — Cat. No. 278-704.

SPECIAL PANEL MARKINGS

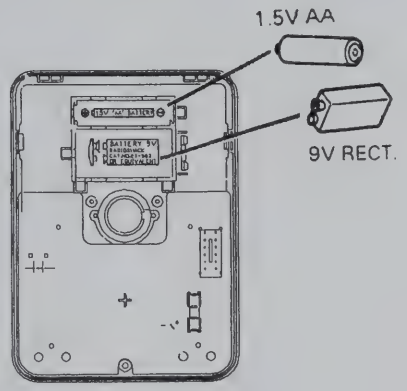
These special markings are added to the multitester's panel to remind you of important measurement limitations and safety precautions.

500V MAX ⏚	To avoid electrical shock and/or instrument damage, do not connect the common input terminal (– jack) to any source of more than 500 volts with respect to earth ground.
	Refer to the complete operating instructions.
1000V AC 250V DC 500mA DC MAX	The maximum voltage or current between these terminals is 1000 VAC, 250 VDC, and 500 mA DC.
	Be extra careful when making measurements for high voltage; do not touch terminals or test lead tips.
50K – 25KΩ/V DC 10K – 5KΩ/V AC	The multitester's inner resistance is 50 kΩ (DC) or 10 kΩ (AC) per volt with the range doubler switch set to V/2•A/2; 25 kΩ (DC) or 5 kΩ (AC) per volt with the range doubler switch in the V-Ω-A position.
0 dB = 1 mW 600 OHMS	0 dB means that 1 milliwatt is dissipated in a 600Ω impedance device.
	Add the appropriate number in this chart to the dB scale reading.

PREPARATION

INSTALLING/REPLACING THE BATTERIES

You need to install one 9V battery (Cat. No. 23-583 or 23-553) for the 20 MΩ (**x 10k**) and the continuity range, and one 1.5V AA battery (Cat. No. 23-582 or 23-552) for other resistance measurements. Follow these steps to install fresh batteries.



1. Disconnect the test leads from the circuit you are measuring.
2. Set the range switch to **OFF**.
3. Open the cabinet by removing the screw from the back, and remove the old batteries, if necessary.
4. Install the batteries as indicated by the polarity symbols (+ and –) in the battery compartment diagram.
5. Close the cabinet and replace the screw.

Replace the batteries if:

- You cannot bring the pointer to 0 on the **OHMS** scale on each range of the Ohms function by touching the test lead tips together.
- The buzzer does not sound on the **CONT** range when you touch the test lead tips together.

Cautions:

- Never leave weak or dead batteries in your tester. Even leak-proof batteries can leak damaging chemicals.
- Remove the batteries if you do not plan to use the tester for a week or more.

REPLACING THE FUSE

The tester uses an internal fuse to prevent an accidental voltage overload. The fuse blows if voltage is applied when the tester is in the **OHMS** or current range (except the 10A range), or when excess voltage is applied in the 0.25 DCV/0.125 DCV range. When the fuse blows, the meter stops working.

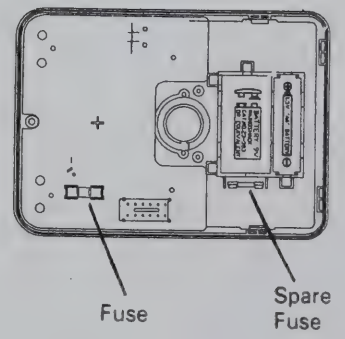
Warning: To avoid electric shock, disconnect the test leads from the circuit under test before removing the fuse.

Caution: For continued protection, replace with a fuse of the same type and rating. We recommend a 0.5A/250V fuse such as Cat. No. 270-1271.

To replace the fuse:

1. Disconnect the test leads from the circuit under test.
2. Set the range switch to **OFF**.
3. Open the tester cabinet by removing the screw from the back.

   There are two fuses in the tester. The circuit fuse is in the metal fuse holder on a board with a red ribbon ring around it. Check this fuse when the tester stops working.
4. Remove the blown fuse by pulling the red ribbon ring.
5. Place the ribbon on the replacement fuse.
6. Insert the replacement fuse into the metal fuse holder.
7. Close the tester cabinet and replace the screw.



OPERATION

METER READING

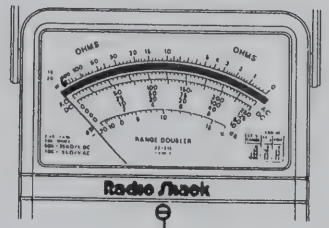
- Keep the tester on a flat, non-metallic surface for the most accurate readings.
- Select a setting that gives a reading in the upper ⅓ or ½ of the meter scale.
- When you read the scale, look at it from the point where the pointer and its reflection in the mirror come together.
- Read from the scale that matches the color of the function you select – green for **OHMS**, red for **ACV**, and black for **DCV/DCA** and decibels.

To read the AC/DC scale, use the appropriate markings based on the selected range.

Marking	Selected Range
0 to 250	0.25, 2.5, 25, 250
0 to 125	0.125, 1.25, 125
0 to 50	5, 50, 500
0 to 10	10, 1000

ZERO ADJUSTMENT

If the pointer does not normally rest exactly over the zero at the left side of the **AC/DC** scale, adjust the plastic screw in the center of the tester face to bring the pointer to zero.



Zero Ajust Screw

OHMS ADJUSTMENT

When measuring resistance on each **OHMS** range, you must bring the pointer to 0 at the right side of the upper green **OHMS** scale.

To do this, connect the black test lead to the **–COM** jack and the red test lead to the **+V-Ω-A** jack. Set the range switch to one of the OHMS positions. Then touch the test lead tips together, and adjust **OHMS ADJ** to bring the pointer to 0 on the right side of the **OHMS** scale.

Notes:

- You must do this adjustment whenever you change the **OHMS** range.
- If you cannot adjust the pointer to 0 on the **OHMS** scale when the range switch is set to the **x1**, **x10**, or the **x1K** position, replace the 1.5V AA battery.
- If you cannot adjust the pointer to 0 on the **OHMS** scale when the range switch is set to the **x10K** position, replace the 9V battery.

RANGE-DOUBLER SWITCH

If the reading is in the lower half of the scale when you measure ACV, DCV, DCA, or dB, set the range doubler switch to the **V/2•A/2** position to divide the range setting by two. This gives you more accurate readings.

When you use the **V/2•A/2** setting, divide the range switch setting by two and read the appropriate scale.

Examples:

- The range switch is set to **250 AC V** and the range doubler switch is set to **V/2•A/2**: The range is 125 volts (250 divided by 2) and you should read the red scale, following the 0 to 125 markings.
- The range switch is set to **10A** and the range doubler switch is set to the **V/2•A/2** (the black test lead is connected to the **–COM** jack and the red test lead to the **+10A DC** jack). The range is 5A (10 divided by 2), and you should read the black scale, following the 0 to 50 markings.

USING THE TEST LEADS

Use only the same type of test leads supplied with your tester. These test leads are rated for 1200 volts. Replacement test leads (Cat. No. 278-704) are available at your local Radio Shack store.

Caution: Although these test leads are rated for 1200 volts, the maximum rating of the tester is 1000 VAC/DC. Do not attempt to measure any voltage greater than 1000 VAC/DC.

Always observe correct test lead polarity when making DC measurements. The black lead should always be connected to the **–COM** jack. If you connect using the wrong polarity, the tester's pointer swings to the left and goes out of range. Connect the red lead to the **+V-Ω-A** jack for making DC voltage measurements up to 250 V, DC current up to 500 mA, all AC voltages (up to 1000 VAC), and all resistance measurements.

Connect the red lead to the **+1000V DC** jack when measuring DC voltages from 250-1000 V. Connect the red lead to the **+10A DC** jack when measuring DC current from 500 mA to 10 A.

Warning: Never allow your fingers to touch the bare metal portion of the test leads (or circuit points) during measurements.

Caution: Always disconnect the test leads when you have finished using the tester.

DC VOLTAGE MEASUREMENTS

Warning: Use extreme care when making high-voltage measurements. Do not touch the terminal or test lead tips.

1. Plug the black test lead into the **-COM** jack.
2. Plug the red test lead into the **+V-Ω-A** jack if the voltage to be measured is under 250V. For voltages between 250-1000V, plug the red test lead into the **+1000V DC** jack.

   If you do not know the voltage level, plug the red test lead into the **+1000V DC** jack and start with the **250/1000V** range. If the meter reading is in the lower half of the scale, plug the red test lead into the **V-Ω-A** jack and lower the range using the range and range doubler switches until the reading is in the upper ½ or ⅓ of the scale.

   Note: Use the **+1000V DC** jack only with DC voltages of 250 to 1000V.
3. Set the range switch to one of the **DCV** positions.

   Caution: When excess voltage is applied to the **0.25 DCV** or **0.125 DCV** range, the fuse in the tester will blow, and the tester does not work until you replace the fuse.
4. Connect the test lead tips to the circuit to be tested, with the red lead to the positive supply and the black lead to the negative supply.
5. Set the range and the range doubler switches to get a meter reading in the upper ½ or ⅓ of the scale.
6. Read the voltage on the black **DC** scale.

If the range doubler switch is set to **V/2•A/2**, divide the range switch setting by two and read the appropriate scale.

AC VOLTAGE MEASUREMENTS

Warning: Use extreme care when making high-voltage measurements. Do not touch the terminal or test lead tips.

1. Plug the black test lead into the **-COM** jack and the red lead into the **+V-Ω-A** jack.
2. Set the range switch to one of the **ACV** positions. If you are uncertain about the level of the voltage to be measured, it is best to start at the highest range (**1000V**) and work down the scale.
3. Connect the test lead tips to the circuit to be tested.
4. Set the range and the range doubler switches as required to get a meter reading in the upper ½ or ⅓ of the scale.
5. Read the voltage on the red **AC** scale, following the black numbers printed below the red scale.

If the range doubler switch is set to the **V/2•A/2** position, divide the range switch setting by two and read the appropriate scale.

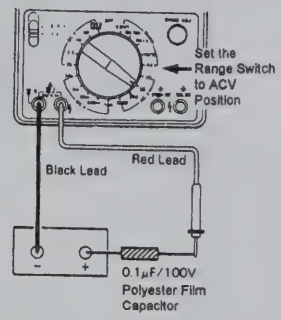
HIGH-VOLTAGE MEASUREMENTS

When you use the tester to probe for a voltage in a high-voltage circuit, we recommend that you do not try to position both of the test leads at once. Instead, clamp one lead to the neutral or ground lead of the circuit, using Radio Shack insulated slip-on alligator clips (Cat. No. 270-354). Then probe for voltages with the other probe and put your free hand in your pocket. This helps prevent you from accidentally touching a hot wire, since you need only concentrate on one test lead.

Warning: Never clamp to a hot wire. If you do and then touch the other probe connected to the tester, you could receive an electric shock.

AC VOLTAGE RIDING ON A DC SOURCE BIAS MEASUREMENTS

When measuring an AC voltage superimposed on a DC voltage source bias, you cannot make ordinary measurements. In this situation, if you know the approximate voltage of the device to be measured and the voltage is under 30V AC on a DC source bias, you can measure the voltage by connecting a 0.1 µf/100 V polyester film capacitor in series with the positive terminal of the voltage source and the red test lead. Set the range switch to either the 10 or 50 **ACV** position.



Warning: Do not make this type of measurement if the AC voltage is greater than 100V with respect to earth ground.

MEASURING 3-PHASE AC VOLTAGES

We designed your meter to measure household AC voltage. It is not intended for commercial or industrial use. Please note the following regarding 3-phase AC voltages.

Warnings:

- Because of the dangers inherent in measuring 3-phase circuits, do not use this meter for such applications. The actual voltage can be greater than the circuit's rated line-to-ground voltage.
- To determine the line-to-line voltage, multiply the rated line-to-ground voltage by 1.732 (the square root of 3).

  For example, if the rated line-to-ground voltage is 640 volts, the line-to-line voltage is:

  $640 \times 1.732 = 1108$ Volts

  This voltage exceeds the meter's rating and you should not connect the meter to this circuit.

RESISTANCE MEASUREMENTS

Warning: Do not apply voltage to the test leads when the range switch is in an **OHMS** position. Doing so causes the fuse to blow, and the tester stops working.

Before taking any resistance measurements, disconnect power to the unit under test and discharge any capacitors. It is best to remove any batteries from the unit under test and unplug any line cords.

To make resistance measurements:

1. Plug the black test lead into the **–COM** jack and the red test lead into the **+V-Ω-A** jack.
2. Leave the range doubler switch in the **V-Ω-A** position.
3. Set the range switch to one of the **OHMS** positions.
4. Touch the test lead tips together and adjust **OHMS ADJ** to bring the pointer to 0 at the right side of the green **OHMS** scale.

   Note: You must adjust the pointer to 0 each time you change ranges in the **OHMS** function (except the **CONT** position). If you cannot adjust the pointer to 0, replace the battery. See "Installing/Replacing the Batteries."
5. Connect the test lead tips across the circuit or part under test.

   Note: When measuring a part's resistance, disconnect one side of the component under test so the remainder of the circuit does not interfere with the readings.
6. Read the resistance on the green **OHMS** scale.
7. Use the appropriate multiplier to find the correct resistance value. Multiply the value that the pointer indicates in the scale by 1, 10, 1000, or 10,000 depending on the range switch's position.

When trying to identify the cathode and anode ends or the type of transistor (PNP or NPN), the actual poliarity of the tester's voltage is the opposite of the test lead colors. The red test lead is the negative source and the black test lead is positive.

CONTINUITY CHECK

Follow these steps to check for continuity in a wire or circuit.

1. Plug the black test lead into the **–COM** jack and the red test lead into the **+V-Ω-A** jack.
2. Set the range switch to **CONT** on the **OHMS** range.
3. Touch the test lead tips together to check the built-in buzzer.
   If the buzzer does not sound, replace the 9V battery.
4. Connect the test leads to the unit under test.

If the resistance is between 0 and 300Ω, the built-in buzzer sounds.

Note: The buzzer's sound level decreases as the resistance increases.

DC CURRENT MEASUREMENTS

To measure current, you must break the circuit and connect the test leads in series with the circuit.

Warning: Do not apply voltage to the test leads when the range switch is set to a **DCA** position. Doing so blows the fuse, and the meter stops working.

Note: The 10A range is not fuse protected.

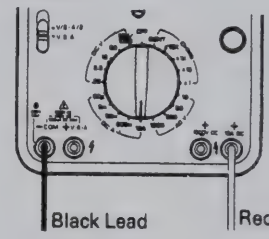
1. Set the range switch to one of the **DCA** positions.

   If you do not know the current level to be measured, start at the highest **10A** range, then lower the range using the range doubler and range switches.

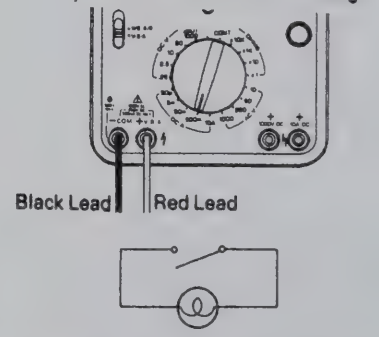
2. Connect the red test lead to:
   - **+10A DC** to measure current over 500 mA and under 10 A.
   - **+V-Ω-A** to measure current of 500 mA or less.
3. Connect the black test lead to the **–COM** jack.
4. Remove power from the circuit under test and break the circuit at the appropriate point.
5. Connect the test leads in series with the circuit (black lead to the negative side and red lead to the positive side).
6. Apply power to the circuit under test.
7. Set the range doubler and range switches as required to get a reading in the upper ½ or ⅓ of the scale.
8. Read the current on the black **DC** scale.

   Note: If you set the range doubler switch to **V/2•A/2**, divide the range switch setting by two and read the scale.

10A Range



50 µA/5 mA/50 mA/500 mA Range



DECIBEL MEASUREMENTS

1. Plug the black test lead into the **-COM** jack and the red test lead into the **+V-Ω-A** jack.
2. Set the range switch to one of the **ACV** positions.
3. Connect the test lead tips to the circuit under test.
4. Set the range doubler switch as required to get a reading in the upper ½ or ⅓ of the scale.
5. Read the lower black **dB** scale, adding the appropriate number of decibels to the **dB** scale as noted on the chart at the lower right of the scale. For example, if the pointer indicates +12 dB and the range switch is set to **50 AC V** and the range doubler switch is set to **V/2•A/2**, add 14 decibels to the indicated value. The result is +26 dB.

   Note: For the most accurate decibel readings, the circuit impedance must be 600Ω.

CARE AND MAINTENANCE

Your Radio Shack Range Doubler Multitester is an example of superior design and craftsmanship. The followir suggestions will help you care for the meter so you can enjoy it for years.

Keep the meter dry. If it gets wet, immediately wipe it dry. Liquids can contain minerals that can corroc the electronic circuits.

Use and store the meter only in normal temperature environments. Temperature extremes can shorte the life of electronic devices, damage batteries, and distort or melt plastic parts.

Handle the meter gently and carefully. Dropping it can damage the circuit boards and cause the mete to work improperly.

Wipe the meter with a damp cloth occasionally to keep it looking new. Do not use harsh chemicals cleaning solvents, or strong detergents to clean the meter.

Use only fresh batteries of the recommended size and type. Always remove old or weak batteries. The can leak chemicals that destroy electronic circuits.

Keep the meter away from dust and dirt, which can cause parts to wear prematurely.

Modifying or tampering with your meter's internal components can cause a malfunction and might invalidate th meter's warranty. If your meter is not performing as it should, take it to your local Radio Shack store for assistance

NOTES

RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 90 days from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

EXCEPT AS PROVIDED HEREIN, RADIO SHACK MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Some states do not permit limitation or exclusion of implied warranties; therefore, the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state

We Service What We Sell

RADIO SHACK
A Division of Tandy Corporation
Fort Worth, Texas 76102

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811024260D
Printed in Hong Kong

OPERATING INSTRUCTIONS FOR THE

MICRONTA®

TRANSISTOR TESTER

Catalog No. 22-024

CUSTOM MANUFACTURED FOR

RADIO SHACK A DIVISION OF TANDY CORPORATION

The "GO/NO-GO" position is for "quick-check" use. R1 is normally shorted out on small-signal transistors, and open on power types. R3 serves as a base current control, and also furnishes feedback control. (Feedback and base current are maximum at GO/NO-GO.)

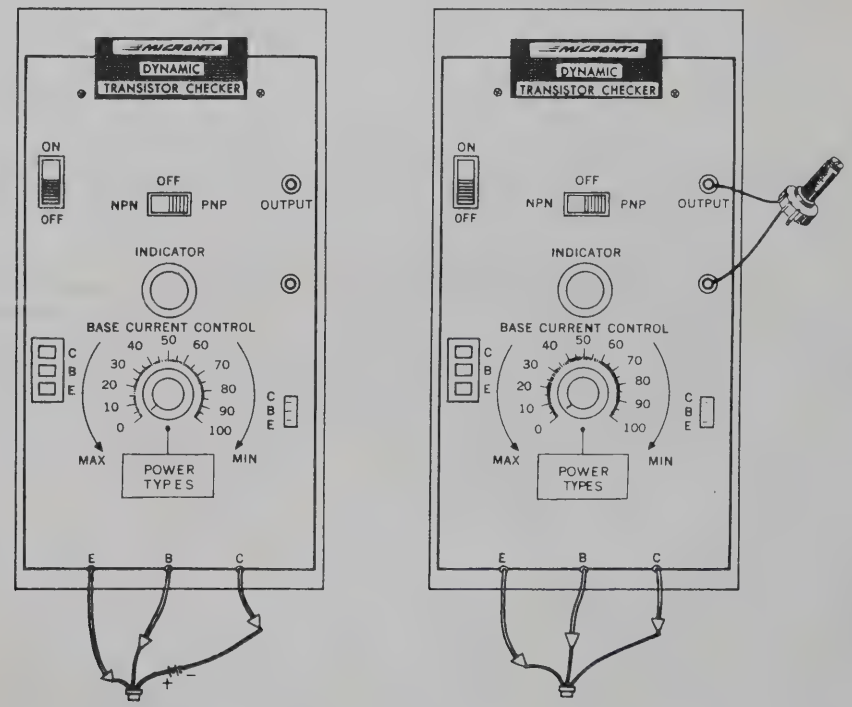
In matching similar type transistors, observe the point of output signal "dropout". Minimum base current occurs at "100". If the dynamic leakage distribution of both transistors under test is similar, then oscillation "dropout" will occur at the same dial setting for each. Naturally, since the dial is not calibrated, these reading will serve for comparison purposes only.

To take advantage of the maximum versatility available in the Transistor Tester, you will want to note these suggestions:

By connecting extra batteries in series with the collector leads, increased operating potential is available (see Fig. 1).

By connecting a 500 ohm variable resistor across the output jacks, increased current loading is possible on power type transistors (see Fig. 2).

OPERATING INSTRUCTIONS:



MICRONTA

OPERATING INSTRUCTIONS:

Radio Shack's new 'Micronta' Transistor Tester is capable of ckecking a wide range of transistor types, either "in circuit" or out of circuit. It has been specially designed to take advantage of the newest concept of dynamic testing under current amplifier conditions.

To use, simply plug the transistor to be checked into the front panel socket, or connect it with the alligator clip test leads provided. No preliminary set-up is needed The unit safely and automatically identifies low, medium and high-power PNP and NPN transistors.

It provides a visual indication of signal output, giving positive information on the following tests simultaneously:

(A) Electrode Open Circuits
(B) Short Circuits
(C) Current Gain

The visual indication of the output signal is the result of dynamic current gain in an actual operating circuit. Further leakage tests are unnecessary, as the dynamic distribution of leakage is taken into account in testing.

The 'Micronta' Transistor Tester also permits matching similar transistors in actual operating circuits, and provides a reliable GO/NO-GO test at practical collector currents (from 5 ma on small signal types to 50 ma and more on power types). Match similar type transistors by observing and comparing dial readings; the higher the reading, the higher the gain.

To determine distributed leakage, note the firing point of the lamp. The brilliance of the neon lamp gives an indication of greater or lesser output. An adjustable base current control allows you to test transistors over a broad range of current conditions. If operation at increased current is desired, an additional load resistor may be inserted in the jacks.

The use of an AC voltmeter or oscilloscope as an output indicator will show a measurable output on collector currents as low as 5 ma. Jacks are provided for use with these instruments for:

(1) providing amplitude signal output indications
(2) making sensitive noise tests
(3) studying dynamic leakage distribution
(4) wave form inspection

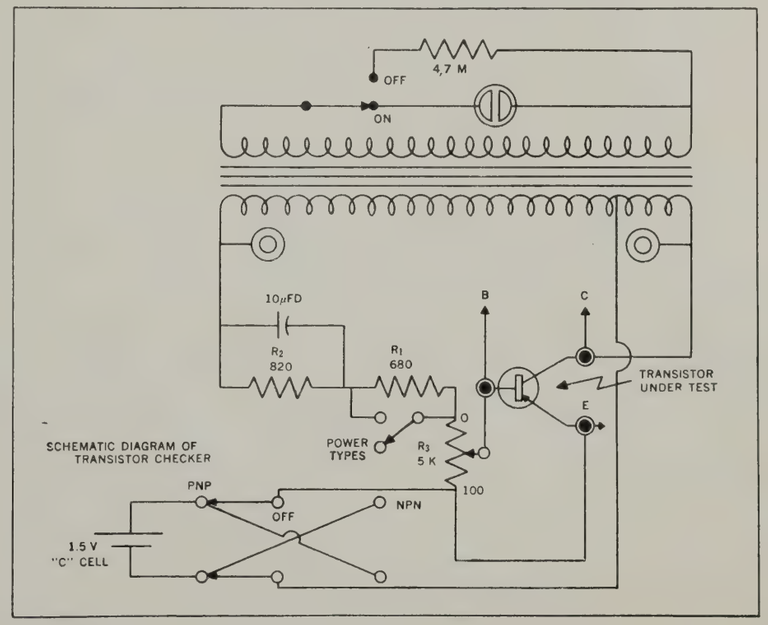
PRINCIPLES OF OPERATION:

A specially designed pulse signal generator is utilized in the Transistor Tester. With a transistor connected to the test instrument, the AC signal developed in the primary winding is stepped up to the voltage necessary to fire the neon glow lamp (#NE-51)

The brightness of the indicator lamp varies in direct proportion to the signal output; hence, the greater the output, the brighter the lamp will glow. When using this unit with a voltmeter or scope, the lamp switch is opened (OFF) to prevent clipping or limiting due to the lamp being left in the circuit.

For "quick check" applications, set the base current control knob at "0". Advancing the knob will then reduce the base current to establish the power operating collector currents. The higher the dial reading at the point a given transistor drops out of operation, the higher the gain

(Refer to Schematic Diagram Below)



The "GO/NO-GO" position is for "quick-check" use. R1 is normally shorted out on small-signal transistors, and open on power types. R3 serves as a base current control, and also furnishes feedback control. (Feedback and base current are maximum at GO/NO-GO.)

In matching similar type transistors, observe the point of output signal "dropout". Minimum base current occurs at "100". If the dynamic leakage distribution of both transistors under test is similar, then oscillation "dropout" will occur at the same dial setting for each. Naturally, since the dial is not calibrated, these reading will serve for comparison purposes only.

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By connecting extra batteries in series with the collector leads, increased operating potential is available (see Fig. 1).
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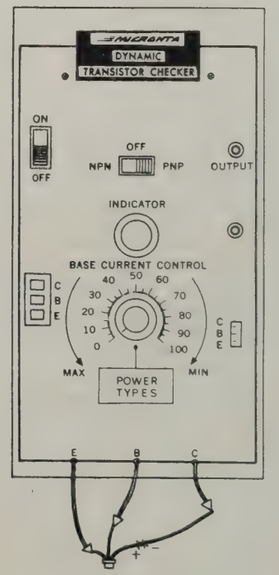
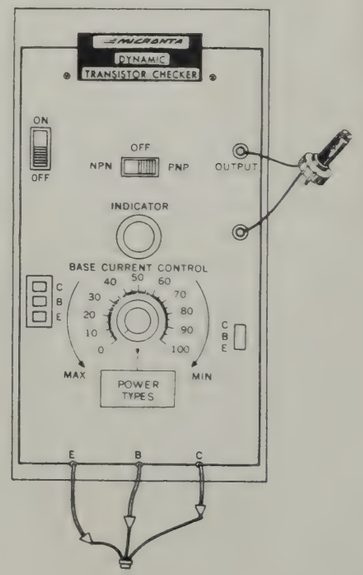




1. Turn base current control knob to "0".
2. Turn lamp switch to "ON".
3. Set PNP/NPN slide switch selector to the type under test. If you do not know the correct type, see Step 6 below.
4. Insert transistor in socket or connect test leads: E (black), B (green), C (red).
5. Neon indicator lamp will glow if transistor is providing current amplification; this means it is not "open" or "shorted".
6. CAUTION: Transistors will fire the indicator lamp only if the NPN/PNP selector switch is set in correct position. However, no damage can occur with switch in wrong position as long as the base current control knob points to "0".
7. To match similar type transistors: note the dial setting at which the lamp glows or output "drops out". The higher this setting, the greater the gain will be, since the base current decreases as the setting is turned towards "100". Maximum base and collector currents occur at "0".
8. Power types should be tested with control knob set to "POWER TYPES". Match as indicated above.
9. If ample output is available, attach the collector lead to the battery contained in the test unit.
10. In case of excessive loading, isolate the transistor's emitter lead and attach the "E" test lead to the emitter lead, continuing test with all other leads in place.
11. Type selector switch should be left in OFF (center) position when instrument is not in use

IN-CIRCUIT TEST PROCEDURE:

For in-circuit testing, the resistor R1 is shorted by switching control knob to POWER TYPES position. Attach test leads to the in-circuit transistor. If a radio or an audio amplifier is being tested, its gain controls should be set at maximum in order to minimize base circuit loading. On the great majority of transistors, the output will be sufficient to fire the neon indicator. If the radio is turned on, the generated tone will also serve as a signal injector, and the output tone will be heard in the speaker. If the tester's built-in power supply furnishes too little output, the collector may be moved to the collector supply end of the battery; this increases the collector voltage, but does not change the base current supply.

CHECKING VERY LOW CURRENT TRANSISTORS:

1. If the output is not high enough to operate the indicator lamp, use a voltmeter (preferably a VTVM type) or an oscilloscope to get an output indication.
2. Set control knob at "POWER TYPES" and note change, if any.
3. Rotate base current control from "0" through "100" and note whether output is best at some point other than the usual "0" position.
4. Insert additional batteries in series with the collector lead only. Observe polarity: negative end of battery goes to collector on PNP types; positive end on NPN. See schematic diagram.
5. Since the neon lamp loads the transformer only when it is glowing, keeping the lamp switch in the "ON" position while checking very low outputs will provide greater output at the test jacks. A 470 ohm resistor loads the transformer when lamp is "OFF".

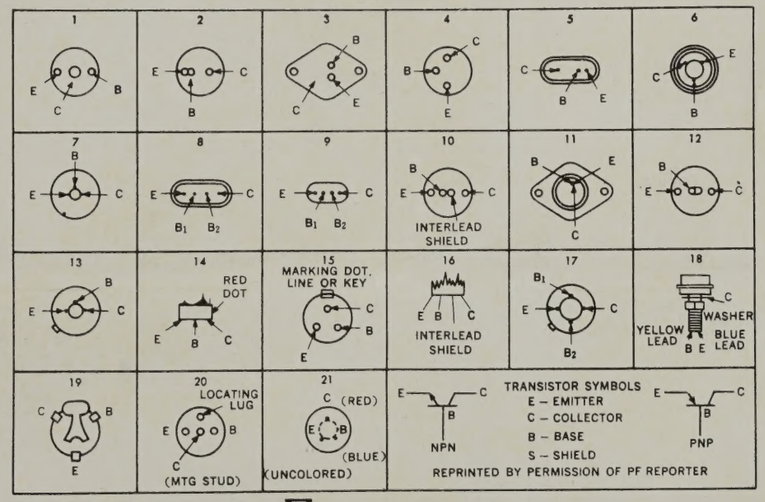
NOTE:

To check battery condition, touch the E and C test clips together briefly; neon lamp should flash if battery is in good condition.

When the voltage across a 100 ohm resistor connected between E and C reads less than 1.1 volts DC, replace battery with a fresh one.

Never operate the tester with the neon lamp out of its socket! The lamp serves as a voltage limiter and regulator, and without it, dangerously high voltages can result.

TRANSISTOR SYMBOL CHART



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OPERATING INSTRUCTIONS FOR THE

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TRANSISTOR TESTER

Catalog No. 22-024

CUSTOM MANUFACTURED FOR

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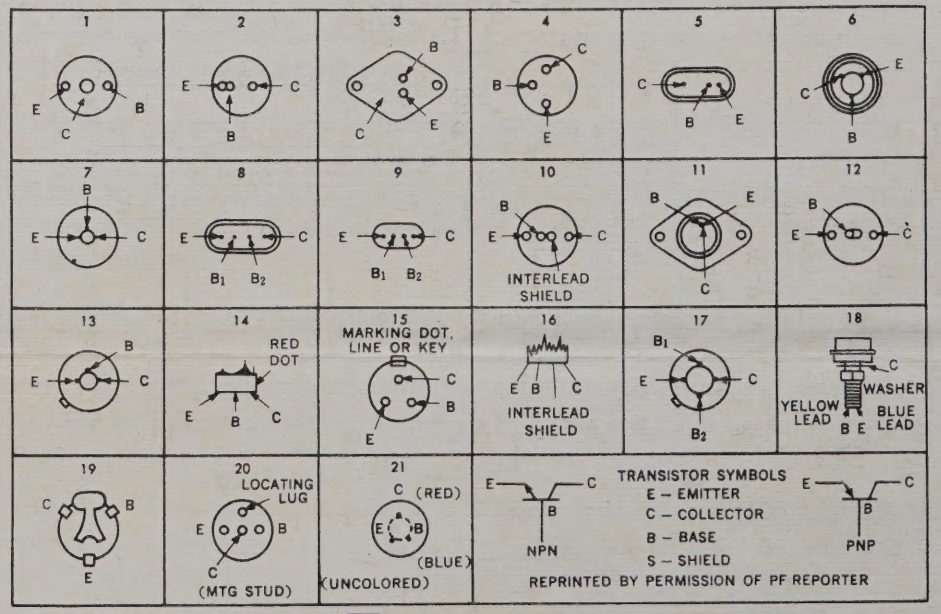

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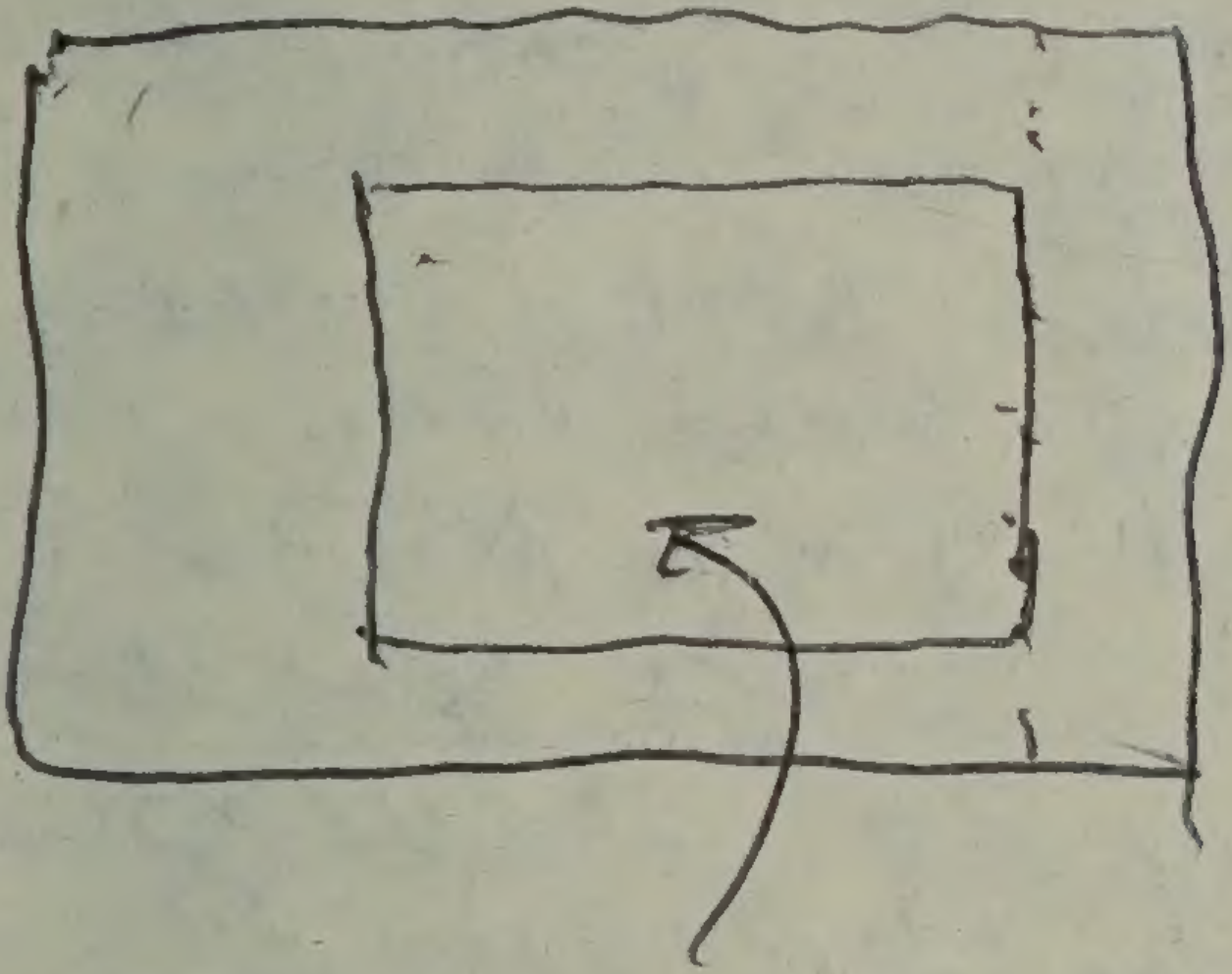
"How To" Copy

1. Feed first side in using the center of the printer.

2. SCAN each page (other side) with the print reversed and to the right of face down (over) center



BE SURE
that PART FACE
DOWN is
reversed from NORMAL
(upside down)